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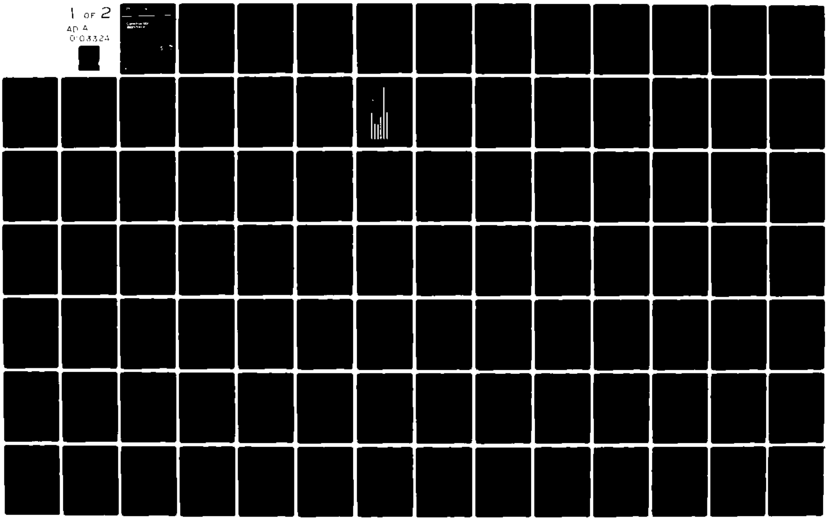

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This survey of the Corps of Engineers construction workforce has two primary objectives: 1) To develop an empirical basis for determining employment benefits due to construction of Corps projects; 2) To develop an empirical basis for determining the socioeconomic impacts of the workforce utilized for Corps project construction on local communities. This study is based on a 51-project sample selected from 136 projects under construction during 1979.

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by

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SURVEY OF CORPS CONSTRUCTION WORKFORCE

EXECUTIVE SUMMARY

Purpose

This survey of the Corps of Engineers construction workforce has two primary objectives:

a. To develop an empirical basis for determining employment benefits due to construction of Corps projects.

b. To develop an empirical basis for determining the socioeconomic impacts of the workforce utilized for Corps project construction on local communities.

Payments to workers who would otherwise be unemployed (or underemployed) in the absence of a Corps project are called employment benefits. The Corps uses employment benefits in its benefit/cost calculations and has used them to influence priorities for new construction starts during periods of recession. These estimates have been attacked because they have in large measure been made with little empirical evidence to support them. A major goal of this study, therefore, was to develop credible empirical data for the calculation of employment benefits. A strong indication of whether workers would be otherwise unemployed in the absence of a Corps project is the length of time they have been unemployed prior to being employed on the construction project. Therefore, this study has developed information on the prior unemployment status of the contract construction workforce employed on Corps projects.

Project construction brings short term residents to local communities. These residents increase the demand for local public services, often without equivalent increases in local revenues. Communities sometimes request assistance to cure the alleged deficit and to help mitigate social stress which often comes with an influx of "outsiders." In order to manage these issues effectively, planners must have some means of estimating the size and demographic composition of a population in-migrating into local areas because of a Corps construction project. This report provides these estimates.

The survey used to generate the data base which is presented in this report was designed to be compatible with similar efforts undertaken by the Water & Power Resources Service (formerly Bureau of Reclamation) and Tennessee Valley Authority. The Economic Development Administration (EDA) undertook a major policy study which investigated the impacts of EDA construction grant projects on unemployment. Thus, the combined efforts of many agencies can lead to a more sound basis for assessing the impacts of Federal public works projects.

This study is based on a 51-project sample selected from 136 projects under construction during 1979. Over 65 percent of the

construction workforce employed at the 51 projects at the time of the survey responded. The data base represents 4,089 complete responses from workers at a cross-section of Crops projects in various stages of completion and localities in varied local labor force conditions in 1979.

The following sections present the major findings of the survey. First are findings about the prior unemployment status of construction workers employed on Corps projects. Next are findings about the distribution of the workforce between local and non-local workers, as well as other characteristics of the workforce which would be useful for identifying the demand on local community services associated with Corps construction projects. Finally, an example is provided showing how findings from this study can be used to calculate employment benefits, and to assess the demands on local community services.

Unemployment Status of the Workforce

Of 4,089 workers responding to the question, 39.6 percent reported some unemployment immediately prior to beginning work on Corps projects. Clear differences in previous unemployment status were found among the workforce according to occupational group, locality, and the project area EDA status. Previous unemployment status showed no association with region or type of project. Unskilled workers are more likely to have been previously unemployed than skilled or white collar workers, and skilled workers have higher rates of previous unemployment than do non-local workers. Projects located in EDA areas have higher rates of workforce previous unemployment than do projects located in non-EDA areas.

Findings suggest that different factors are associated with previous unemployment for unskilled, skilled, and white collar segments of the workforce. For unskilled workers, remoteness of the project areas, as well as the region's general level of construction activity, are associated with previous unemployment. For skilled and white collar groups, previous unemployment is related to an ensemble of socioeconomic factors which give a region a less competitive edge; examples of these factors include EDA designation, below average educational attainment, and low per capita income. For all occupational groups the regional unemployment rate was strongly associated with previous unemployment.

Under current regulations, employment benefits are restricted to projects located in EDA designated counties which have approved redevelopment plans. These counties are a subset of all EDA counties declared eligible for EDA assistance; differing only in that they have an approved redevelopment plan. Survey findings show that significant numbers of otherwise unemployed workers are employed on Corps projects located in EDA areas, not only in EDA areas with redevelopment plans, but also in the other EDA designated areas. In fact there was no statistically significant difference in the proportion of previously unemployed workers employed at projects located in counties with approved redevelopment

plans and at projects located in other EDA designated areas. This finding calls into question the rule restricting employment benefits to only EDA areas with redevelopment plans.

While EDA areas are designated on the severity and persistence of unemployment, it is likely that almost every local economy will have some structural problems and a pool of individuals who are out of work because of such imperfections. Survey findings show that although previous unemployment in non-EDA areas is less than in EDA areas, it is by no means trivial. This finding suggests that employment benefits may legitimately accrue to non-EDA designated areas as well.

Adjustments to unemployment figures obtained in the survey were made to factor our seasonal, discretionary, and frictional unemployment. Several tables were then generated using variables which analysis had shown to be associated with previous unemployment of the workforce. From these operations a table estimating previous unemployment of the workforce at Corps projects was generated (Table 1).

Estimating Demands on Local Community Services

The survey revealed that a large majority of the Corps' National construction workforce is composed of local workers (69.4 percent). White collar workers are much more likely to be non-local than either skilled or unskilled workers. Projects in the Western United States have higher proportions of non-locals employed than projects elsewhere in the country. Based on limited analysis, it appears that the proportion of non-locals employed on a project remains constant over the course of the construction project.

The proportion of the workforce at projects which is non-local is most closely associated with factors which influence a regions's ability to supply a pool of labor. For regions with smaller populations the proportion of non-locals employed on a project is greater. Regions which have higher rates to unemployment and which are EDA-qualified areas have a relatively greater pool of potentially employable local workers. These variables show modest negative association with the proportion of non-locals employed on a project. Regression equations were developed which predict the number of non-local workers employed on a project. The equations are likely to offer a useful means of estimating the number of non-local workers a project will employ.

Analysis of the non-local workforce characteristics reveals that, for the most part, non-local workers only expect to remain at their present location until the project is completed. Most workers bring dependents with them. Non-local workers, whether accompanied by dependents or not, try to locate as close as possible to the project site. Workers with dependents are also concerned with obtaining housing adequate for family needs. Housing choices for these workers are more likely to run to single family

Table 1. Estimates of Previous Unemployment

Project Area Location	Percent of Workforce Previously Unemployed		
	Local Workers		
	Unskilled	Skilled	White-Collar
EDA areas with regional unemployment rate of 6% or greater	42.7	32.8	22.1
EDA areas with regional unemployment rate of less than 6%	32.0	25.7	22.1
	Non-Local Workers		
	Unskilled	Skilled	White-Collar
All areas	32.0	21.3	22.1

and mobile homes than are the choices of workers with no dependents present.

In particular, the analyses suggest the following:

(1) Approximately 60 percent of the Corp's non-local workforce is accompanied by dependents.

(2) A ratio of 1.24 dependents to each non-local worker was computed. This ratio is independent of geographical area of the country where projects are located.

(3) A greater portion of non-local workers occupy more temporary types of housing (apartments, motels, boarding rooms, travel trailers) than local workers.

(4) For non-local workers, nearness to project site seems to be the most important housing choice location criterion.

(5) Less than one in three non-local workers intend to remain in the immediate vicinity of the project area after completion of the project.

Using survey data to calculate employment benefits and assess community service impacts.

Employment Benefits

The IWR Study has empirically documented the previous unemployment of the Corps construction workforce. The Table developed offers a means for estimating the employment benefits produced by a Corps civil works construction project. Inputs needed to develop such estimates are as follows:

- o Number of workers by skill designation
- o Locality of workforce by skill
- o Location of project in terms of:

    County EDA status

    Regional unemployment rate

Each of these information inputs is discussed in greater detail below.

Number of Workers

An estimate of the number of workers to be employed on the construction project forms the base for calculating employment benefits. The methodology for deriving estimates of labor requirements for projects is beyond the scope of the present study; however, a number of sources for developing these estimates are

available. Among them are statistics maintained by the Bureau of Labor Statistics and WPRS on total dollar amounts of construction for various types of heavy construction activities and man-years of labor (Bingham, 1978; WPRS, 1980); and detailed statistics on construction project labor requirements compiled by F.W. Dodge Co. and made available in labor estimates produced by the Department of Labor's Construction Labor Demand System (Department of Labor, 1977).

Locality of Workforce

It has been shown that the previous unemployment of the workforce varies according to the variable of locality. Accordingly, the proportion of the workforce which is local and that which is likely to be non-local should be estimated. The regression equation in Table 3.12 of the survey report provides such an estimation of total numbers of non-local workers. Using Table 3.2, estimates of the occupational skill category of this workforce can be obtained. This Table indicates that for the national survey the non-local workforce was composed of 15.1 percent unskilled workers; 59.2 percent skilled and 25.7 percent white collar workers.

Location of Project

Two inputs are required. First, the EDA status of the county in which the project is to be constructed should be determined. Second, a regional laborshed for the project should be constructed using the procedure described in Section 1.3.1 of the report. The unemployment rate for this region can then be obtained from state employment or labor statistics departments.

The information and estimate developed above can then be used in conjunction with the appropriate tables shown in Table 1 of this summary to develop estimates of number of previously unemployed workers. Appropriate wage rates can be multiplied by these workers to yield estimates of employment benefits.

For example, assume a reservoir is to be constructed; assume a three-year construction schedule. Labor requirements of construction are: year 1 = 250; year 2 = 700; year 3 = 300 workers.

The estimated occupational distribution of workers is as follows:

	Construction Year		
	1	2	3
Unskilled	55	154	66
Skilled	160	448	192
White Collar	35	98	42
	250	700	300

To compute employment benefits, perform the following steps:

a. Locality of Workforce

(1) Estimate total non-local workers using regression equation:

Number year 1 = .213 (PEAK*) -8.9 = 44
year 2 = = 140

year 3 = = 64

(2) Estimate occupational breakdown of non-local workers.

	Construction Year		
	1	2	3
Total non-local workers by occupational category	44	140	64
Number unskilled = 15.1% X Total	7	21	10
Number skilled = 59.2% X Total	26	83	38
Number white collar = 25.7% X Total	11	36	16
Total	44	140	64

Non-local workers

(3) Estimate occupational breakdown of local workers. Subtract non-local to obtain.

	Construction Year		
	1	2	3
Unskilled	48	133	56
Skilled	134	365	154
White collar	24	62	26
Total	206	560	236

Local workers

------

*where PEAK = number of workers required for construction year.

b. Location of Project

(1) EDA status: Assume county is located in EDA-designated area

(2) Regional unemployment rate: 6.9%

c. Compute Previous Unemployment

(1) Estimate previously unemployed local workers.

Year 1	Total local workers		Values from Table 1		Number Previously Unemployed
Unskilled	48	*	.427	=	21
Skilled	134	*	.328	=	44
White Collar	24	*	.221	=	5

(2) Estimate previously unemployed non-local workers

Year 1	Total Local Workers		Values from Table 1	Number Previously Unemployed
Unskilled	7	*	.320	2
Skilled	26	*	.213	6
White Collar	11	*	.221	2

(3) Repeat (1) and (2) above for construction years 2 and 3.

d. Compute a Wage Bill for Previously Unemployed Workers. Assume an "average wage" for occupational skill levels of $8.00/hr, unskilled; $13.00/hr. skilled; $12.00/hr. white collar.

(1) Wage bill, year 1 = x+y+z where
x = Total number of unskilled workers previously unemployed * year 1 annual wage unskilled
= 23 * $16,640 = $382,720
y = Total number of skilled workers previously unemployed * year 1 annual wage skilled
= 50 * $27,040 = $1,352,000
z = Total number of white collar workers previously unemployed * year 1 annual wage white collar
= 7 * $24,960 = $174,720
x+y+z = $1,909,440

(2) Compute wage bill for years 2 and 3 in same manner

(3) Compute total wage bill for previously unemployed workers by summing wage bills for years 1 through 3

(4) Add interest on wages paid to previously unemployed workers.

e. Compute Average Annual Employment Benefits

(1) Total employment benefits = total wage bill + total interest on wages

(2) Average annual benefits = total employment benefits * amortization factor. For example, total wage bill in this example = $9,549,280, total interest on wages = $887,190
amortization factor is .075914 assuming a 50 year project
life at 7 5/8 % discount rate
average annual employment benefits = $792,274.

<u>Community Service Impact Assessment</u>

The survey data analyses coupled with the comparative data assembled from other construction worker studies provide a solid empirical base to assess the demand on community services that a Corps project is likely to produce. The procedure for performing such an impact assessment using the survey data is shown in the example below.

As a planner for a Corps of Engineers reservoir project in final design stages, you have been asked by local governments in the reservoir project area to provide an assessment of the impact of the construction project on the community services in the project area. There are several small towns in the vicinity of the construction site and local governments are interested in identifying the range of likely benefits and costs the construction project will produce. What can you tell them?

Information provided by the survey can be used to perform a community impact assessment. The first step in such an assessment would be to calculate the number of non-local workers likely to be employed on the project. Using the regression equation in Table 3.12, an estimate can be produced. Assume that the relevant data for this equation were:

- o Peak anticipated construction: 700
- o Constant: 8.9
- o Number of non-local workers : 140

Next, using the ratio ' 1.24 dependents per non-local worker obtained in Chapter 4, n estimate of 174 dependents is derived. Total population influx directly associated with the construction

project is thus estimated to be 314. Of the dependents, approximately 102 will be children and, of these 102 children, 79 will be school-age.

Housing needs of the incoming workforce can be projected using Tables 4.1 and 4.6. Here, the expected non-local worker population could be broken into 83 accompanied workers and 57 unaccompanied workers. Housing needs of these groups as expressed in Table 4.6 could be derived and matched with available supplies in surrounding communities.

Data strongly suggest that the communities located nearest to the project construction site will receive most of the total population influx of 314. Statements on the actual distribution of this population among nearby communities would have to be conditioned on separate assessments of supply of housing as well as on local government policies to attract or discourage incoming workers. Harnisch (1980), for example, found that one community adopted an aggressive policy to attract as many incoming workers as possible. In this community, zoning restrictions were relaxed and workers were exempted from paying local property taxes. Such policies should be factored into any assessment.

Having identified total worker-dependent influx and having made some judgment of settlement patterns informed by the survey data, as well as local conditions, an assessment of the impact of this influx on existing community services - schools, sewage systems, roads, etc. - can be made.

A method for performing this assessment developed by the Seattle District involves the following steps:

(1) Make "without project" population forecasts for local communities which are likely to be affected by construction-induced population increases.

(2) Inventory the "people capacity" of community services of these communities in relation to "without project" population forecasts.

(3) Allocate incoming populations to local communities on the basis of the survey data presented in this report, as well as on personal knowledge of the local area.

(4) Identify any shortages in community service capacities produced by, or worsened by, the influx of construction workers and dependents. Figure 1, showing how this information can be graphically displayed, is modeled off of a community impact study prepared by Seattle District (Harnisch, 1980). A forthcoming IWR report (Chalmers) provides detailed procedures for identifying, quantifying, and displaying community service impacts.

Data from the survey suggest that of the 140 non-local workers, 44 would remain in the local area after the project is

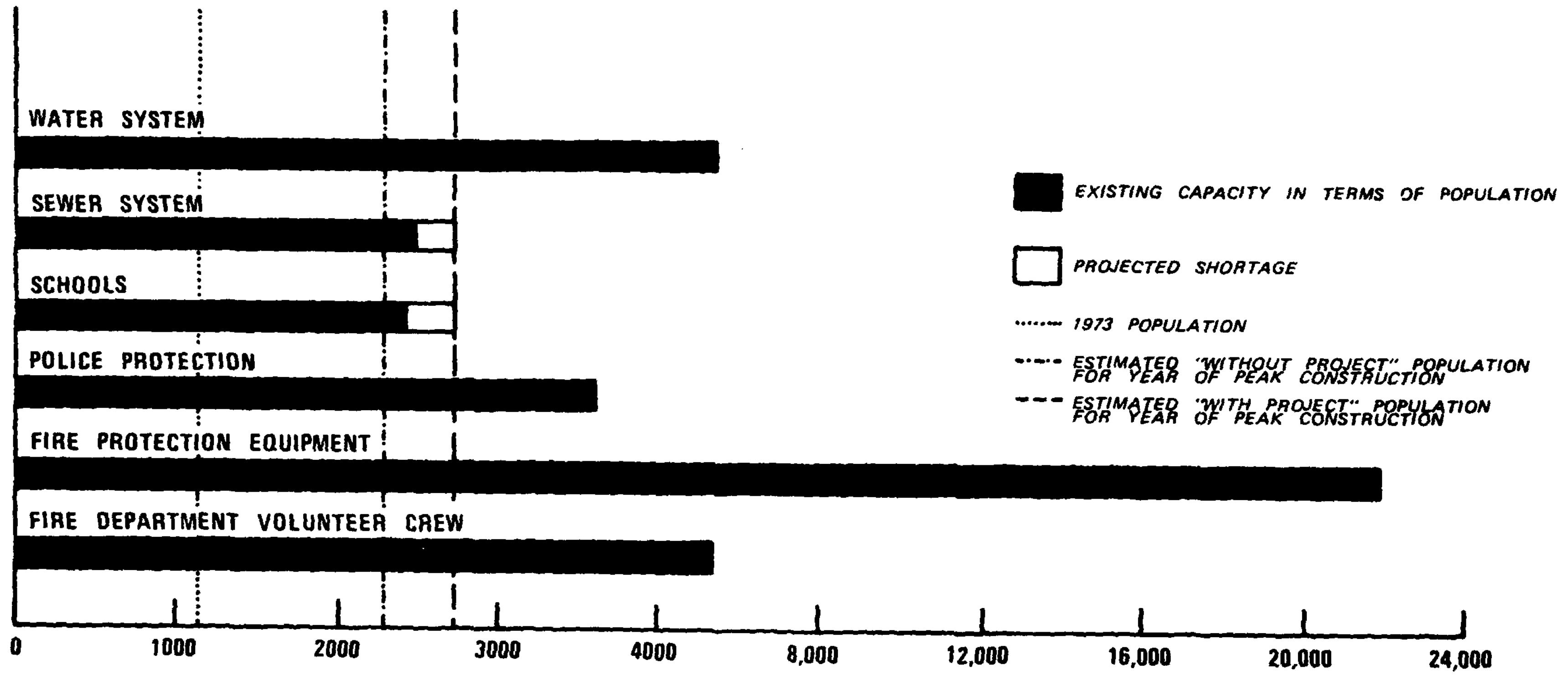

FIGURE 1: SAMPLE DISPLAY OF COMMUNITY SERVICE IMPACTS OF CONSTRUCTION GENERATED POPULATION INFLUX

completed. (Table 4.9.) Of these 44 workers, 26 accompanied workers are included representing about 81 persons, making a total number of individuals who are likely to remain in the local after completion of the project 99. This information can help local governments plan on the character of capital expense outlays for providing services to incoming workers.

Such information can provide Corps planners with the means to assist local governments in planning for and managing impacts associated with a Corps construction project.

It should be noted that the uncertainty concerning such community impacts is likely to be worse than the actual impacts themselves. For example, the "average" project in the current survey had 124 workers employed at the time of the survey. Of these workers, it is estimated that 40 were non-local. Assuming the ratio of 1.24 dependents per non-local worker, the average construction project brings only about 90 persons into the local area. In most local project areas, a population influx of this size would not produce appreciable community service impacts.

CHAPTER 1

INTRODUCTION

1.1 Research Objectives

This survey of the Corps of Engineers construction workforce has two primary objectives:

a. To develop an empirical basis for determining employment benefits due to construction of Corps projects.

b. To develop an empirical basis for determining the socio-economic impacts of the workforce utilized for Corps project construction on local communities.

Payments to workers who would otherwise be unemployed (or underemployed) in the absence of the Corps projects are called employment benefits. The Corps uses employement benefits in its benefit/cost calculations and has used them to influence priorities for new construction starts during periods of recession. These estimates have been attacked because they have in large measure been made with little empirical evidence to support them. A major goal of this study, therefore, was to develop credible empirical data for the calculation of employment benefits. A strong indication of whether workers would be otherwise unemployed on the construction project is the length of time they have been unemployed prior to being employed on the construction project. Therefore, this study has developed information on the prior unemployment status of the contract construction workforce employed on Corps projects.

The regulation concerning the computation of these benefits has been promulgated in the "Procedures for Evaluation of National Economic Development (NED) Benefits and Costs in Water Resources Planning" (Water Resources Council, 1979). According to this regulation employment benefits are limited to areas officially designated as Title IV redevelopment areas under the Public Works Economic Development Act of 1965. Upper bounds for benefit estimates are also established by the regulation; however, agencies are allowed to change some of these limits if credible empirical data can be supplied to justify higher estimates of the percent of workforce which would be otherwise unemployed. The IWR construction worker survey provides such an empirically-derived data base for estimating employment benefits.

The second objective addresses the need for better information on workforce characteristics for estimating the social and community service impacts associated with the construction of projects. Construction of large-scale projects can induce increases in demand for local public services (especially schools, sewer and utilities) (Freudenberg 1976, 1977; Harnisch, 1978c);

can encourage desirable or undesirable urban and rural development; and can contribute to increases in both public revenues and expenditures for services; and conflicts between local residents and incoming workers which appear to be linked to differences in life style and cultural background (Freudenberg, 1977; Gold, 1974).

These effects result from the influx construction workers accompanied in some cases by dependents. Developing ways of estimating the size of the population influx to be expected as well as estimating other characteristics and needs of the group which relate to the demand for social services is thus requisite to the effective management or mitigation of potentially adverse community service impacts. This report provides these estimates.

To address these objectives this study systematically analyzes the following:

- The previous unemployment status of the workers
- The distribution of the workforce between local and non-local workforce
- Characteristics of the non-local force: number of dependents accompanying non-local workers; types of housing occupied; commuting patterns; and reasons for locational choices made by the non-local workforce.

1.2 Prior Research Work

The research builds on a small, but growing base of studies concerned with identifying and measuring the impacts of construction activities. This work is reviewed below. First are studies which have considered the issue of the employment effects of public works projects; second are studies which have examined the other socioeconomic characteristics of the non-local workforce.

1.2.1 Studies of the Employment Efforts of Public Works Projects

Haveman and Krutilla (1963) have provided the classic description of the problems associated with the evaluation of the employment effects of public works projects. They developed the concept of labor response functions which related the probability of using otherwise unemployed workers on public works projects to regional unemployment levels. Kim (1972) used labor response functions to estimate the employment effects of Appalachian water resource projects. Kim also estimated the construction employment benefits of the McClellan-Kerr Arkansas River Navigation System using an inter-regional input-output model to show direct and indirect imports of construction expenditures across the United States (Kim, 1977). In aggregate the $1.1 billion construction budget for the project was shown to have increased national output by $6.4 billion and household income by $2.1 billion. Other studies of the Arkansas project showed that 83 percent of the project

construction workforce was composed of local workers (Godwin, et al., 1977).

The previous employment status of construction workers has been most extensively examined in the evaluation study of the Public Works Impact Program conducted by the Economic Development Administration (EDA), (Sulvetta and Thompson, 1975). This study evaluated the impact of the EDA construction grant programs for small public works projects and identified factors which were most closely associated with the use of previously unemployed workers on public works projects.

Workers at 208 EDA projects were individually interviewed and asked about their employment status prior to beginning work at EDA projects. Workers were defined as unemployed if they had been out of work for more than two weeks and had actively been seeking employment (Sulvetta, personal communication, 1980). The EDA study found that 38 percent of the workforce had been unemployed prior to assuming employment on the EDA projects. (Sulvetta and Thompson, 1975; Table II.C.5.).

Two studies have been conducted which have examined the unemployment experience of construction workers on water resource projects. The larger of these studies, performed for the Water and Power Resources Service (WPRS) (formerly Bureau of Reclamation) examined 12 projects. Information on previous unemployment experience of workers was obtained from questionnaires. The study found that an average of 51 percent of all workers had experienced some unemployment in the six weeks preceding employment on the WPRS construction projects (Chalmers, 1977a). The results also indicated that the unemployment of many workers was not merely associated with moving from one job to another; 60 percent of workers with unemployment experience had been unemployed for more than 26 days out of the six weeks considered (Chalmers, 1977a: 21).

A study employing the same questionnaire used in the WPRS study has been performed at the Corps of Engineers Chief Joseph Powerplant construction site (Harnisch, 1978a). This research was primarily undertaken to measure community service impacts associated with construction activities. The study revealed that 58 percent of construction workers had been unemployed before coming to work at the project. Of the total reporting some unemployment, 45 percent had been unemployed 26 days or longer in the six weeks prior to beginning work at Chief Joseph (Harnisch, 1978a, Table 10).

1.2.2 Studies of Socioeconomic Characteristics of the Workforce

Several studies have been performed which have focused on the socioeconomic characteristics of the construction workers. These studies include the WPRS construction worker surveys cited above; a survey of electric generating facility construction projects conducted by researchers at North Dakota State University (Leholm,

et al, 1976); surveys of the workforce engaged in the construction of electric powerplants conducted by Battelle Laboratories (Malhotra and Manninen, 1979); and construction worker monitoring efforts conducted by the Tennessee Valley Authority (DeVeny, n.d.). Findings from these studies will be compared to findings obtained in the IWR survey. Table 1.1 compares several procedural details of these studies with the IWR study.

1.3 Study Design and Execution

This section consists of three major parts. Section 1.3.1 defines the variables used in the study; Section 1.3.2 describes the design of the sampling process used to select projects for the study; Section 1.3.3 presents data collection strategies used in the survey.

1.3.1 Variables

Three types of variables are employed in the study:

- Workforce characteristic variables
- Project characteristic variables
- Project area variables

1.3.1.1 Workforce Characteristics Variables

These variables were measured using a self-reporting questionnaire. The questionnaire and procedures for distributing it are described in Section 1.3.3. The questionnaire is reproduced in Appendix A. Workforce characteristic variables include:

- Previous employment status
- Locality of workers
- Occupation
- Length of employment on project
- Intention of remaining in local area
- Education
- Marital status
- Number of dependents
- Location of dependents
- Residential location preferences of non-local workers
- Previous residence of non-local workers

Table 1.1. Comparison of Construction Workforce Studies

	IWR	WPRS	North Dakota U.	Batelle	TVA
Date of Survey	Summer 1979	Summer 1977	Summer 1975	Not provided	1968-1975
Number of Projects Surveyed	55	12	2	13[a]	6[c]
Responses	4089	688	264	Not provided	9627
Response Rate	65%	52%	24%	82%	75%
Location of Projects	Nationwide	Western United States	North Dakota	Northeast, Midwest Southeast and South	Southeast
Type of Projects	Water	Water	Electrical generating	Electrical generating	Electrical generating

a. A total of 28 separate surveys were conducted at 13 projects - thus some projects were surveyed at different stages of completion. Several different research groups conducted the surveys and employed different survey instruments (Malhotra and Manninen, 1979, p. 10).

b. While not provided in the report total number of workers at projects at time of survey equals 58,770. With an overall reported response rate of 82% estimated responses equals 48,191.

c. Extracted from TVA report, Table 3, for the following projects: Paradise (Jan 68); Cumberland (May 71); Browns Ferry (Apr 71); Watts Bar (July 74); Sequoyah (Jul 72); Bellefonte (Apr 75).

- One way distance to work

a. Previous Employment Status. The measurement procedure employed for this variable was that of the WPRS study. Workers were asked if they had been unemployed before taking the job on the Corps of Engineers project. Workers answering affirmatively were then asked to report the total number of working days they were unemployed for the six weeks prior to beginning work at the Corps project. For purposes of this study a work week consisted of five working days, making a total of 30 days of unemployment in a six week period the maximum. Responses from workers reporting greater than 30 days unemployment were coded as 30. The measurement procedure does not apply an official definition of unemployment such as it is used by the Department of Labor (to be out of work and actively seeking work); but instead relies on the assumption that the individual can accurately define his own employment status. This approach has been used in studies of chronic unemployment (Thompson, 1965).

b. Locality. The locality of the workforce has been defined in a number of ways in several other construction workforce surveys. The most common distinction of locality is "non-local" and "local" workers. Non-local workers are generally defined as those workers whose address while working at the project is reported as being in a community different from the worker's address prior to the time of employment on the project. (cf Chalmers, 1977, Leholm, et al 1976). Other studies have drawn somewhat finer distinctions in terms of movers and non-movers; (movers as those who change residence to work on the project) and in terms of local and non-local: (local workers as those who live within 15 miles of the project site) (Malhotra and Manninen, 1979: 35). This study has employed the distinctions used in the WPRS and North Dakota State University studies to define locality of workers. Since this definition classifies anyone in-migrating to a community as a non-local, it is adequate to accomplish the task of identifying those individuals who are likely to create social service impacts. Finer detail about locality of workers can be developed since zip codes for workers' present and previous addresses were obtained. Using zip codes, additional locality dimensions can be created.

c. Occupation. The occupation of workers was recorded using the Standard Occuapation Classification System (Department of Commerce, 1975) recorded to the fourth digit. Using this system, a boilermaker, for example, is classified as 7214, and a general construction laborer as 8100. This system allows occupations to be inspected individually or aggregated into general skilled, unskilled or white collar categories. Much of the analysis in this report employees occupation aggregated in these latter three categories. Workers were placed into these categories on the basis of Table II.E.6 of the 1975 EDA Report.

d. Length of Employment on Project. This variable is computed as the number of months a worker has been employed on the Corps project.

e. Intention of Remaining in the Local Area. This variable is measured in the IWR survey by asking respondents "Do you plan to remain in this town or the immediate area after completion of this project if acceptable employment is available in the area?" The question leaves open the interpretation of "immediate area" to the respondent; however, the question seems able to differentiate those individuals who plan to change residence from those who do not. Again from the standpoint of community impact assessment requirements this level of detail is sufficient. The wording of this question is also similar to a question employed in the Battelle study (Malhotra and Manninen, 1979; p. 82).

f. Education. A worker's educational level was measured as the highest grade he/she had completed in school.

g. Marital Status. Attributes of this variable were not-married and married.

h. Number of Dependents. This variable was measured by asking workers two questions. The marital status of the worker; and the number of children the worker has. Total dependents was computed as follows: if a worker indicated he/she was now married, number of dependents equals 1 plus the total number of children under 19 years of age. If the worker indicated he/she was not now married, number of dependents equals total number of children under 19 years of age.

i. Location of Dependents. Workers were asked to indicate whether their dependents were living at the same local place of residence from which they commuted to work or if they lived elsewhere.

j. Residential Location Preferences. Residential location preference refer to factors identified as being important in choosing residential locations. (Rossi, 1955; Speare, 1974). Respondents were asked to select two factors which were most important in choosing a particular residential location.

k. Previous Residence. Non-local workers were asked to provide the name of the town where they resided prior to assuming employment at the Corps project. The zip code for this location was then determined and encoded. Using this variable it may be possible to differentiate in-migrating workers from within a general region from those coming from outside the region.

l. One-Way Distance to Work. This variable is measured as the one-way distance in miles from place of local residence to project work site.

1.3.1.2 Project Characteristic Variables

These variables classify Corps projects according to certain criteria. They include:

- o Project Type
- o Size of Project
- o Completion Stage of Project

Abbreviations for several of these variables employed in subsequent analyses appear in parentheses.

a. Project Type. Corps projects were differentiated on the basis of project authorization data presented in Corps of Engineers programming and Financing Circular dated 1978.

Categories are Flood Control, Reservoirs, Power Projects, Channels and Harbors, Locks and Dam Projects, and Beach Erosion Projects, as well as Replacement Projects for each of the above categories. These categories may be useful as ways to differentiate projects on the basis of particular skill requirements or construction requirements.

Project categories can be somewhat artificial for large projects which involve many types of construction activities or for small projects which may be one part of a larger authorization project. For example, two projects in the southwest are reservoirs being constructed as part of an overall project with a flood control authorization. In addition, some categories are similiar in terms of the type of construction and production requirements - e.g., reservoirs and/or power projects. Therefore, the utility of the variable project type to yield useful distinctions in the date has proven to be somewhat limited.

b. Project Size. Project size was defined in a number of ways. Overall cost of the project, Fiscal '79 Construction Budget (COST), Number of Employees at Peak of Construction (PEAK), and Total Employees Working at the Project at the time of the survey (EMPTOS) were all employed as measures of project size. Each measure captures a different dimension of project scale.

c. Completion Stage of Project. Project Completion Data were obtained from project offices. The variable is measured as the percent of total project construction completed at time of survey.

1.3.1.3 Project Area Characteristics

This study employs a number of variables to explain the employment, locality and other characteristics of the workforce. The variables are derived from a conceptual focus emphasizing local labor market characteristics and spatial relationships between

project areas and regions. Abbreviations for the variables appear in parentheses. They include:

- Project Area Population (POP70, POP75)
- Project Area Unemployment Rate (UNE79)
- Project Area Construction Force (CON77)
- Project Area Employed Civilian Labor Force (LAB70)
- Distance of Project Area to Nearest SMSA (SMSA)
- Project Area Educational Attainment (EDUC)
- Project Area Average of Population Density (DEN75)
- Project Area Per Capita Income (INC75)
- Number of Cities Greater Than or Equal to 10,000 Population within 25 Miles of Project Site (CIT25)
- Labor Shed Population (LPOP70, LPOP75)
- Labor Shed Unemployment Rate (LUNE79)
- Labor Shed Construction Force (LCON70)
- Labor Shed Employed Civilian Labor Force (LLAB70)
- Labor Shed Average Educational Attainment (LEDUC)
- Labor Shed Average Population Density (LDEN75)
- EDA Status of Project (EDA)
- Locality of Project Principal Contractor (CTRLL)
- Major Construction Projects in Region (SUMBDE)

A basic distinction between many of the above variables concerns whether they are measured at the "project area" or "labor shed" levels of detail. The project area was defined by a 15-mile radius from the outermost reaches of the project. Using the determined radius, those counties which have 50 percent or more of their area encompassed by the radius were classified as being in the project area. The labor shed was defined as those counties with at least 50 percent of their area encompassed within a 50-mile radius of the project site. These definitions are somewhat arbitrary, but convey local and regional dimensions to the data obtained. They were also consistent with definitions employed on the recent Battelle Study (Malhotra and Manninen, 1979).

a. Population, Labor Force, Education, Density Per Capita Income. These variables were obtained from 1970 and 1975 Census sources.

b. Unemployment Rate. April 1979 unemployment figures were obtained for each county from state labor departments.

c. Construction Force. Data on employment in the construction industry were obtained from state labor departments. Figures are for 1977; the latest information uniformly available.

d. Distance of Project to Nearest SMSA. This variable was computed by using straight line distance rather than highway miles.

e. Number of Cities with Population > 10,000. Straight line distance from the project site was used to draw a 25 mile radius. The number of cities or towns partially or totally encompassed by the circle with 1970 population of 10,000 or more were counted.

f. EDA Status of Project. The EDA status of the project indicates if the project is located in a county designated by the Economic Development Administration as eligible for EDA benefits. EDA-designated areas must have a high or persistent unemployment (EDA, 1978). The EDA status of projects was obtained from an EDA map of designated areas dated July 1978.

g. Locality of Contractor. On each project a principal contractor was defined as the contractor employing the greatest number of workers. If the principal contractor had a permanent headquarters within the labor shed area the contractor was defined as a local contractor; if there were no permanent headquarters within the labor shed area the contractor was defined as non-local.

h. Major Construction Projects in Region. This variable was computed using information supplied by the U.S. Department of Labor's Construction Labor Demand System (CLDS) (Department of Labor, 1979). Data on the number and dollar value of all construction projects of greater than $50 million cost were supplied by BEA. Region in this instance, therefore, refers to the BEA that a Corps of Engineer local project area is located within. For this variable total dollar cost of large-scale construction projects (defined as costing in excess of $50 million) was computed.

1.3.2 Sample Design

The major considerations of the sample designs were: (1) to develop information representative of the national Corps work contract force and (2) to develop information about pertinent characteristics of the Corps workforce which can be generalized to future Corps construction projects. This latter objective would be in support of providing Corps planners with a means of estimating

non-local influx of population and other workforce characteristics for projects which are still in the planning stage. This two-fold objective made it most feasible to select Corps projects as the appropriate sampling frame. A representative sample of Corps projects under construction would generate the National workforce sample and at the same time, this sample of projects could be used for multi-variate analysis of workforce characteristics at individual projects.

1.3.2.1 Population

The population for the study consists of all Corps of Engineer projects under active construction during June 1979. Procedures employed to identify this population were as follows. First, a list of all projects for which Construction General monies were requested for Fiscal Year 1979 was obtained from the Office of the Chief of Engineers. These projects were then grouped by Corps Division and by general project type. This list included 196 ongoing projects and 35 projects for which funding for new construction starts were requested. Requests were made to each division to supply information on the current number of construction workers in the project, the particular phase of construction a project was in and relevant details on future construction schedules.

Information supplied by Divisions indicated that 130 construction projects employing some 13,370 workers were active in September 1978. The difference between the figure of 196 supplied by OCE and actual number results from the fact that some of the projects which could be in the construction stage were awaiting funding. In addition to the 130 active construction projects, an additional 24 projects were indicated by Division personnel as new starts in FY 79. From this list of 154 projects, eight projects in the North Atlantic and New England divisions were selected for testing purposes. This effectively eliminated all NAD and NED projects from the population. In addition, it was determined to restrict the survey only to those projects within the continental United States. This eliminated the six projects for the Pacific Ocean Division and one project each in the North Pacific and South Atlantic Divisions, making a survey population of 136 projects.

1.3.2.2 Sample Selection of Projects

The survey population was stratified on the basis of project type. A proportionate stratified random sample was drawn. A ratio of sample size to survey population of 0.6 was employed which yielded a total sample size of 80 projects. This target sample size provides adequately for workforce characteristics expressed as proportions (e.g., proportion of workforce previously unemployed, etc.) with accuracy of approximately + 1.5 percent at a 95 percent confidence level. That is, proportions obtained from the sample should have a 95 percent probability of being within ± 1.5 percent of the true Corps National workforce figure.

From this list of 80 projects, 51 were actually surveyed.[1] During initial meetings with division personnel to coordinate survey questionnaire distribution it was learned that some of the projects initially included in the survey population and sample would not be under construction or would have fewer than 10 contractor employees. These projects were dropped from the survey at that time. Once the survey was underway, several additional sample projects were not included. In some cases this was because an anticipated new start had not received funding or contracts had not been awarded. In other cases, the project was simply between construction periods at the time. An effort was made to survey all projects in June 1979. Inclement weather conditions caused some delays into July 1979 thru October 1979.

It should be noted that the reduction of sample projects from 80 to 51 also reduced the size of the population from 135 to 110, since the projects not surveyed were not under active construction. As a result of the diminuation in the sample size, some types of projects were over represented. Project type as a classificatory variable may be of limited usefulness since differences in the sample that are associated into project type may be an artifact of the sampling process.

The sample is of sufficient size, however, that the stability of measures of central tendency are assured. The survey employed a somewhat large sampling fraction of 0.6 in anticipation that the vagaries of the construction process would make it difficult to survey all projects in the sample.

1.3.2.3 Completion

A total of 6,271 questionnaries were distributed at the 55 construction projects surveyed. Of this total 4,089 forms were returned, making a completion rate of 65.2 percent. This response rate is considered a favorable indicator of the anonymous nature and ease of questionnaire completion as well as the high level of determination and motivation of Corps field staff involved in distribution of the questionnaires. Table 1.2 shows response rates of each of the 55 projects surveyed. Appendix C presents several comparisons of sample and population characteristics.

1.3.3 Data Collection

1.3.3.1 Questionnaire

The questionnaire employed to gather information on the worker characteristics is a revision of the questionnaire employed in the WPRS Studies and on the Chief Joseph study. The updated

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1. Two of the 51 projects surveyed were area offices (Huntington and Pittsburgh). Each area office had three separate projects under construction making the total number of construction projects surveyed 55.

Table 1.2 Sample Projects

Project Name [a]	Division	Project Type [b]	Date of Survey [c]	Number of Survey Forms Distributed	Number Returned	Response Rate (%)
Central and South Florida	SAD	FC	June 79	60	49	81.7
Dade County, Florida	SAD	FC	June 79	151	68	45.0
ATWW Bridge Replacement, N. Car.	AAD	CH	June 79	30	29	96.7
Masonboro Jetties, N. Car.	SAD	Ch	June 79	23	23	100.0
Cooper River, S. Car.	SAD	CH	June 79	89	87	97.8
DuVal County, Florida	SAD	Be	July 79	30	19	63.3
Tennessee-Tombigbee Waterway (SAD portion)	SAD	LD	July 79	864	359	41.6
Patoka Lake, Ind.	ORD	R	August 79	116	82	70.7
Cave Run Lake, Ky.	ORD	R	June 79	69	69	100.0
Paintsville Lake, Ky.	ORD	R	Sep 79	87	76	87.4
Caesar Creek, Oh.	ORD	R	June 79	59	59	100.0
East Fork Lake, Oh.	ORD	R	June 79	26	22	88.0
Burnsville Lake, W. Va.	ORD	R	June 79	2	0	0
R. D. Bailey Lake, W. Va.	ORD	R	July 79	103	75	72.8

Table 1.2. (Continued)

Project Name	Division	Project Type	Date of Survey	Number of Survey Forms Distributed	Number Returned	Response Rate (%)
Laurel River, Ky.	ORD	P	June 79	18	11	61.1
Smithland Lock and Dam, Ky., Ind.	ORD	LD	June 79	428	262	61.2
Wolf Creek Dam, Ky.	ORD	R-P	June 79	78	50	64.1
Huntington Projects	ORD					
. Beech Fork Lake, Oh.	ORD	FC	Aug 79	8	0	0
. BGU Alum Creek, Oh.	ORD	FC	Aug 79	4	4	100.0
. Chillicothe LPP, Oh.	ORD	FC	June 79	17	15	88.2
Pittsburgh Area Projects						
. Millvale F.P.	ORD	FC	July 79	10	10	100.0
. Unit 4, Fulton F.P.	ORD	FC	Aug 79	30	24	80.0
. Rehab L&D No. 3, Pa.	ORD	-	July 79	100	48	48.0
Tennessee-Tombigbee Waterway (ORD Portion)	ORD	LD	July 79	1097	628	57.3
Clarence Cannon, Mo.	LMVD	P	June 79	293	288	98.3
Kashkaskia Navigation Project, Il.	LMVD	CH	June 79	40	25	62.5
Red River Waterway, La. Mississippi River to Shreveport	LMVD	LD	July 79	62	62	100

Table 1.2. (Continued)

Project Name	Division	Project Type	Date of Survey	Number of Survey Forms Distributed	Number Returned	Response Rate (%)
Atchafalaya Basin, La.	LMVD	FC	July 79	47	43	91.5
Tensas Basin	LMVD	FC	July 79	53	41	77.4
Mississippi River Levees, Vicksburg District	LMVD	FC	Aug 79	50	43	86.0
Degray Lake, Ark.	LMVD	P	July 79	37	37	100.0
Yazoo Basin, Ms.	LMVD	LD	July 79	253	233	92.1
Cleveland Harbor, Oh.	NCD	CH-R	June 79	71	57	80.3
Ludington Harbor, Mich.	NCD	Ch	June 79	24	14	58.3
Mankato, Minn.	NCD	Fl	Aug 79	42	31	73.8
Waterloo, Ind.	NCD	FC	June 79	57	41	71.9
Fulton, Ill.	NCD	FL	June 79	21	21	100.0
Clinton, Ind.	NCD	FC	June 79	49	47	95.9
Harry S. Truman Dam & Reservoir, Mo.	MRD	P	June 79	401	145	36.2
Ft. Riley, Ks.	MRD	FC	July 79	72	52	72.2
Missouri River, Ft. Randall	MRD	FC	June 79	25	25	100.0
North Texas Area Office	SWD	FC	June 79	115	83	72.2
Addicks Barker, Tx.	SWD	R	June 79	38	29	76.3

Table 1.2. (Continued)

Project Name	Division	Project Type	Date of Survey	Number of Survey Forms Distributed	Number Returned	Response Rate (%)
Los Esteros Lake, N. Mex.	SWD	R	June 79	38	29	76.3
El Paso, Tx.	SWD	FC	Oct 79	15	10	66.7
Abiquiu Dam, N. Mex.	SWD	FC-R	June 79	15	6	40.0
Freeport Hurricane, Tx.	SWD	FC	June 79	26	26	100.0
Optima Lake, Ok.	SWD	R	June 79	29	15	51.7
Joe Creek, Tx.	SWD	FC	Oct 79	63	63	100.0
El Dorado Lake, Ks.	SWD	R	June 79	149	111	74.5
Truskott, Tx.	SWD	R	June 79	60	39	65.0
Cucamonga Creek, Ca.	SPD	FC	July 79	58	38	65.5
Phoenix, Az.	SPD	FC	July 79	25	25	100.0
Warm Springs, Ca.	SPD	R	July 79	304	168	55.3
Applegate Lake, Or.	NPD	R	June 79	232	84	36.2

Notes

a. Project Names are those which appear in OCE Program and Financing Circular dated 1978.

b. Corps Divisions: South Atlantic (SAD); Ohio River (ORD); Lower Mississippi (LMVD); North Central (NCD); Missouri River (MRD); Southwestern (SWD); South Pacific (SPD); North Pacific (NPD).

c. Project Type: FC, Flood Control; R, Reservoir; P, Power; CH, Channel and Harbor; LD, Lock and Dam; BE, Beach Erosion. A (-R) indicates that the project is a renovation of an existing project of the same type.

questionnaire is printed on stiff card stock to facilitate its completion on this job site.

1.3.3.2 Distribution

In devising questionnaire distribution strategies, several factors were important. First, between the researcher and the worker were division, district, branch and project levels of the Corps' organization as well as individual contractor and, in some cases, subcontractor organizations. Moreover, the study was national in scope so there were a wide variety of circumstances and conditions specific to individual projects that were encountered. Given these factors, a participative strategy was devised to involve Corps Division and District personnel in the development of questionnaire distribution procedures. A series of meetings with Division and District personnel was held in the spring of 1979 to outline the overall study plan. At these meetings a number of data collection options were presented. Using group process techniques to facilitate discussions, Division and District personnel helped devise data collection procedures sensitive to individual project circumstances. This procedure yielded effective data collection strategies as well as produced a high level of motivation among Corps personnel to assist in the successful completion of the data collection methods.

While a variety of data collection strategies were employed, the most frequently used included: insertion of questionnaire into employee's pay envelope; distribution of questionnaires at mandatory safety meetings; and field distribution of questionnaires by supervisory or inspection personnel.

1.3.3.3 Pre-test

The questionnaire and distribution procedures were pre-tested on eight North Atlantic and New England Division projects in October 1978. As a result of this test, a new introductory statement on the questionnaire was developed. Refinements to guidance concerning field contractor coordination and distribution practices were also made. Information about workforce characteristics obtained from the pre-test is contained in Appendix B.

1.4 Data Analysis

1.4.1 Plan of Analysis

The primary focus of analysis will be directed to the following:

1. The examination of the proportion of previously unemployed workers in the workforce.

2. An examination of the proportion of non-local workers in the workforce.

3. An examination of the following characteristics of the non-local workforce:

- Type of housing occupied
- Intention to remain in local area
- Number of dependents accompaning worker
- Residential preferences in choosing local residence
- Distance commuted to work

To examine these characteristics the following general plan of analysis is employed:

a. For the workforce:

(1) Univariate frequency distributions of variable attributes.

(2) Bivariate analysis of the distribution of variable attributes introducing of the following variables: occupational skill level, locality of workforce, project type and geographic area.

b. For workforce characteristics aggregated by projects:[1]

(1) Univariate frequency distributions.

(2) Bivariate analyses.

(3) Correlation analysis: Examination of variable interrelationship using zero-order product moment correlation coefficients.

(4) Multivariate analyses: Examination of the distribution of variable attributes with the simultaneous introduction of two or more variables.

1.4.2 Statistical Measures Employed

To perform the various analysis of variable attribute distributions, the following statistical tests will be employed.

a. For the workforce:

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[1] Unless otherwise indicated all analysis of workforce characteristics using projects as the unit of analysis is based on 50 projects rather than 55. Four sampled projects had fewer than 10 workers and were dropped from this analysis. No secondary information was collected for an additional project so it could not be included in correlation and regression analyses.

Chi-Square (X^2): This test evaluates whether frequencies obtained from the cross-tabulation of nominal variables differ significantly from those which would be expected if the distribution were random. The X^2 Test allows the evaluation of the existence of a relationship between two nominal variables of any number of categories. It does not indicate the strength of relationship. The X^2 statistic provides a useful objective yardstick for estimating associations which may be present among variables.

Lambda (asymmetric): This test of association for cross tabulation to two nominal-level variables measures the percentage of improvement gained in the ability to predict the value of one variable if the value of the other variable is known. Lambda varies between 0 and 1.0, where 0 means no improvement in prediction; and 1 means prediction can be made without error, i.e. each independent variable category is associated with a single category of the dependent variable (Nie, et al, 1975). Thus while X^2 measures association, lambda provides a measure of the strength of association between variables.

Difference of Proportions. This statistic tests whether the difference between two proportions is significant or arises out of sampling fluctuation. The test involves the computation of a Z-score for the difference between the two proportions. This score can then be compared against a table of areas under the normal curve to obtain a significance level. (Blalock, 1960:176).

b. For workforce characteristics, aggregated by project:

T-Test and Analysis of Variance (ANOVA): These statistics evaluate whether the means of samples belong to the same population. They assume normality, independent random samples, and equal population standard deviations. Moderate departures from these assumptions can be tolerated in the tests (Blalock, 1960:249).

Correlation and Regression. Zero-order Pearson product-moment correlation coefficients are examined for the dependent variables and project area characteristic variables. Ordinary least squares multiple regression techniques are employed to assess the mutual influence of project area characteristics identified in correlational analysis in explaining the variation observed in the dependent variables.

1.4.3 Computational Procedures

All computations were performed at the Ft. Belvoir Computer Center using SPSS version 7, mounted on a CDC6600.

1.5 Organization of Report

The following chapters of this report present the analyses outlined above. Chapter 2 focuses on the previous employment status of the workforce, the first major study objective. Chapter 3 examines the locality of the workforce while Chapter 4 examines characteristics of the non-local workforce. These both address the second major objective. Chapter 5 is a summary of findings of the research.

Chapter 2

PREVIOUS EMPLOYMENT STATUS

2.1 Introduction: Employment Status of the Workforce and Employment Benefits

One of the nationally significant effects of public works projects is the impact of construction and operation on unemployment. Utilization of persons, who in the absence of a project would be unemployed or underemployed, results in a net gain in national economic well-being. Since the opportunity cost of otherwise unemployed labor is zero, the actual cost to the economy is zero and, therefore, net benefits of a project are greater and the benefit-cost ratio is increased. Although economic costs are reduced current evaluation procedures require the estimate to be in terms of increased benefits. As the recent Principles and Standards guidance notes:

> The opportunity cost of employing otherwise underemployed workers equals their without-project earnings, which by virtue of their underemployment are less than their market cost. The most straightforward way to reflect the effects of employing unemployed or underemployed labor resources would be to reduce by the appropriate amount the project construction costs in the NED account, but this method would cause accounting difficulties in appropriations, cost allocation and cost sharing. Therefore, these effects are treated as a project benefit in the NED account. (Water Resources Council, 1979)

These benefits are called employment benefits.

The essence of the evaluation problem in calculating employment benefits is to estimate the opportunity costs of the labor which would be utilized in construction and operation. This is what individuals would earn if the project were not built. The extent of prior unemployment or underemployment of a person employed in the construction or operation of a Corps project is the best indicator of the "without-project" situation (Epp, 1979:399).

One of the difficult evaluation issues in determining what proportion of otherwise unemployed or underemployed persons are utilized on a project is the dramatic seasonality of construction employment. The theory linking unemployment with zero opportunity cost is clearly based on the assumption of structural causes of unemployment. Since seasonal factors have little to do with underlying structural conditions, it is likely that the yearly average unemployment rate for construction workers overstates structural unemployment in the construction sector. A recent Department of Labor study notes that seasonal unemployment is caused by factors such as weather, habit, government contracting practices, and labor agreements (Department of Labor, 1979: 33). This study found that seasonality was an important component in determining

the level of unemployment in the contract construction industry; however, seasonality as a factor of importance has been declining in recent years (Department of Labor, 1979: 54). The implication of the Department of Labor study findings for employment benefit calculations is that the seasonal component of construction unemployment may inflate estimates of the percentage of "otherwise unemployed" workers used on projects when these estimates are generated using the previous unemployment status of workers as a proxy for otherwise unemployed workers. In a 1970 study the Bureau of Labor Statistics estimated that one-third of total unemployment in construction during a year can be considered seasonal in nature (Department of Labor, 1970: 3).

In the past, the Corps of Engineers has estimated employment benefits of projects by first determining if the "unemployed pool" of labor around the project could supply positions. If not, it was assumed that construction firms would transfer outsiders into the site. These transfers would be assumed to be employed in the absence of the project. These procedures were not based on empirical studies of the previous employment status of individuals employed on Corps projects, and were therefore subject to criticism.

In the early 1970's, the Economic Development Administration conducted a major study on its program. Results of this study suggested that employment benefits may have been somewhat lower than the Corps had typically estimated. The EDA study also showed that employment benefits could be increased by adopting policies which enhance the probability of using otherwise unemployed people (e.g., awarding smaller contracts, utilizing local contractors, etc.). The Corps was under pressure to develop procedures which would reduce variation in estimates between districts (for similar projects and conditions) and which were founded on competent empirical backup data. This led to a draft Engineer Regulation which used the EDA study to place upper bounds on benefit estimates. At the same time, the number of projects which could qualify for these benefits was limited to EDA-designated counties which had completed an approved employment generating plan. This rule had nothing to do with the presence or persistence of unemployed people who could be used for construction and operations. The current evaluation procedures promulgated by the Water Resources Council carry the spirit of the draft Engineer Regulation discussed above, but allows agencies to change some of the limits if creditable empirical data can be marshalled to refute limitations.

The remaining sections of this Chapter present findings on the employment status of the Corps construction workforce. The sections address the following issues:

(1) The previous employment status of the Corps construction workforce.

(2) Variation of previous employment status with occupational group, locality, region, project type or a project area's EDA status.

(3) Factors which account for construction unemployment.

(4) Methods for estimating previous unemployment in the construction workforce.

2.2 Workforce

The previous employment status of the workforce is summarized in Table 2.1. Of the 4,089 workers queried 1,618 or 39.6 percent reported some unemployment immediately prior to beginning work on Corps projects. Information about the duration of any previous unemployment was obtained by asking workers the number of days they had been unemployed in the six weeks immediately preceding their employment on Corps projects. It was assumed that there were five work days in each week, making a base of 30 days against which to gauge the duration of unemployment. Duration of previous unemployment for all three occupational groups shows that most unemployment reported is substantial averaging 23 to 24 days out of 30 days possible. Some caution must be used in interpreting these figures since length of unemployment was artificially constrained on one side. In this case, it is quite likely that the true means of duration of unemployment lie beyond the boundary imposed by the 30 day limit. Figure 1 is a bar chart showing duration of unemployment expressed in weeks.

2.2.1 Occupation and Employment Status

As might be expected, the attribute of previous unemployment varies according to skill level of the workforce. Unskilled workers had the highest rate of unemployment and white collar workers the lowest. Duration of previous unemployment shows little difference among the three occupational categories, however, ranging between 23 and 24 days on an average for these groups.

The recent WRC guidance on employment benefits has established upper bounds for the three occupational categories reported in this survey. These upper limits are 47 percent for unskilled; 30 percent for skilled; and 35 percent for other (here reported as white collar) (WRC, 1979: 713, 1207). As shown in Table 2.1 these bounds compare with 46.3 percent for unskilled, 41.9 percent for skilled and 26.1 percent for white collar occupational groups.

2.2.2 Locality and Employment Status

Local workers (those workers who have not changed their community of residence since assuming employment on a Corps project) had more previous unemployment than non-local workers. As Table 2.2 shows, 44.3 percent of locals responding to the employment question reported previous unemployment compared to 32.3 percent of non-locals. This finding is consistent with the findings of other studies (Chalmers, 1977; Harnisch, 1978; TVA nd.) Duration of previous unemployment, again however, is very similar for the local and non-local groups.

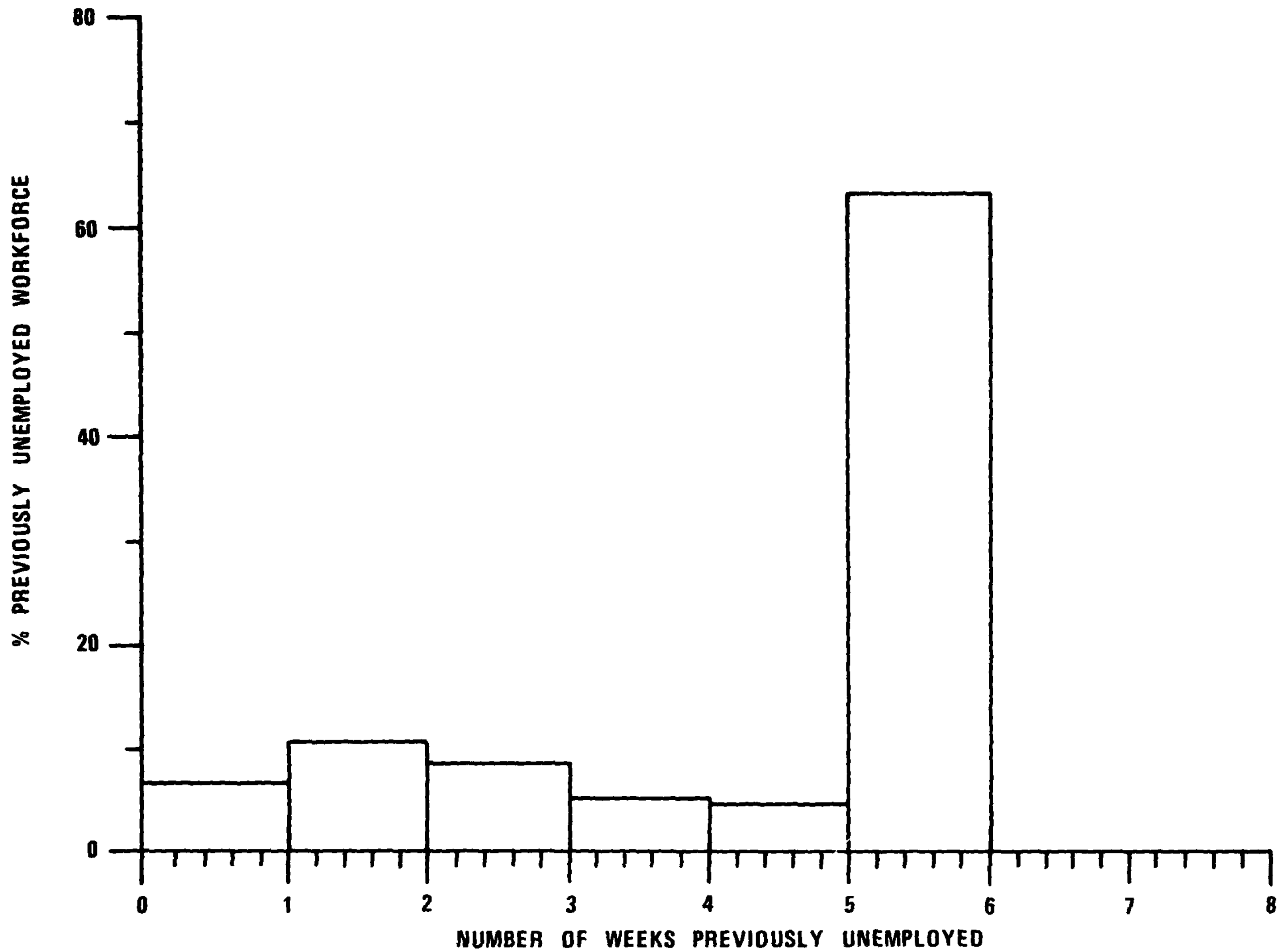

FIGURE 1: DURATION OF PREVIOUS UNEMPLOYMENT

Table 2.1. Previous Employment Status of the Workforce

	Workforce		Occupational Skill: Unskilled		Occupational Skill: Skilled		Occupational Skill: White Collar	
Employment Status	N	%	N	%	N	%	N	%
Previously unemployed	1618	39.6	391	46.3	1052	41.9	149	26.1
Previously employed	2363	57.8	453	53.7	1459	58.1	421	73.9
No Answer	108	2.7	28[1]		66		6	
Total	4089	100.0	872		2577		576	
Duration of previous unemployment								
Mean (days)	23.5		24.3		23.1		24.2	
Valid Cases	1466		358		945		129	
Missing Cases	152		33		107		20	

[1] "No Answer" totals for occupation do not equal 108, because respondents did not answer the occupation question.

Table 2.2. Previous Employment Status, Locality and Occupation

Employment Status	Locality: Local (%)	Locality: Non-Local (%)	Locality and Occupation (%): Local: Unskilled	Local: Skilled	Local: White Collar	Non-local: Unskilled	Non-local: Skilled	Non-local: White Collar
Workers previously unemployed	1224 (44.3)	384 (32.3)	323 (48.6)	799 (44.4)	86 (32.5)	68 (38.9)	246 (35.3)	62 (20.5)
Workers previously employed	1542 (55.7)	805 (67.7)	342 (51.4)	1002 (55.6)	179 (67.5)	107 (61.1)	451 (64.7)	241 (79.5)
Missing Cases: 134			Missing Cases: 183					
Duration of unemployment (days)	23.5	23.5	24.4	23.0	24.4	23.9	23.4	24.1

The difference in previous employment status noted between locals and non-locals is also manifest when these groups are disaggregated by occupational group. A greater proportion of locals have experienced unemployment than non-locals in each occupational group. Once again, duration of unemployment is very similar among groups.

These findings suggest that those projects which have higher proportions of locals employed and/or those projects with higher proportions of unskilled workers are likely to have higher rates of previous unemployment among the workforce. This conclusion is explored in greater detail in the analysis of project level workforce employment status in Section 2.3.

Water Resources guidelines (WRC, 1979: 713, 1207) have established upper bounds for employment benefits for projects with local hire rules. For an 80 percent local hire rate these figures are unskilled, 58; skilled, 43; and other, 35. Table 2.2 shows that local workers' previous unemployment rates are very similar to these bounds for both skilled and white collar ("other") occupational groups. Unskilled previous unemployment is somewhat lower than the WRC upper bound, however.

2.2.3 Employment Status, Geographic Variability and Project Type

This Section explores in a preliminary way the distribution of employment status attributes over geographic area and across project types. It is plausible that factors which are associated with unemployment are not uniformly distributed across the country. It is also plausible that the different types of projects with their different scales of construction activity may have differences with regard to employment status of the workforce. Tables 2.3 and 2.4 represent workforce employment status by geographic area and project type breakdowns. Geographic categories were created by combining projects in Corps of Engineers Divisions to approximate South and Southeast (SAD and LMVD projects); the Central Midwest (ORD and NCD projects); the Southwest and Great Plains (SWD and MRD); and the West (NPD and SPD projects). While these groupings are somewhat arbitrary they nevertheless do describe relatively distinct geographic areas with substantial cultural and economic differences. Project types have been described in Section 1.3.1.2. Rehabilitation projects were placed into their respective general project type categories under the assumption that the general ensemble of skills necessary for rehabilitation would be similar to those required for the same projects under initial construction. The single beach erosion project was classified with the flood control projects, based again on the similarity of scale of construction as well as purpose.

Tables 2.3 and 2.4 show that there is some variation in employment over regional areas as well as by project types. Knowing a particular category of either project type or geographical area, however, does not reduce the error in predicting employment status. It appears that previous unemployment is slightly more

Table 2.3 Employment Status and Geographical Area

Employment Status	South & Southeast N	South & Southeast (%)	Mid-West N	Mid-West (%)	Southwest & Great Plains N	Southwest & Great Plains (%)	West N	West (%)
Unemployed	545	(38.0)	709	(44.2)	139	(34.3)	225	(42.0)
Employed	890	(62.0)	896	(55.8)	266	(65.7)	311	(58.0)

Geographic Area

Total = 3981

Missing Cases = 108

$X^2 = 19.6$ Significance = .0002[1]

Lambda; with employment status dependent = 0[2]

---

1 Significance level indicates probability of obtaining distribution in the Table purely by chance.

2 Lambda is explained in Section 1.5.2.

Table 2.4 Employment Status and Project Type

Employment Status	Project Type									
	Flood Control		Reservoir		Power		Channel-Harbor		Locks & Dams	
	N	(%)	N	(%)	N	(%)	N	(%)	N	(%)
Unemployed	305	(37.4)	322	(37.9)	209	(40.1)	67	(34.0)	715	(44.7)
Employed	510	(62.6)	528	(62.1)	312	(59.9)	130	(66.0)	883	(55.3)

Total = 3981

Missing Cases = 108

$X^2 = 20.9$ significance = .0003

lambda; with employment status dependent = 0

common in Western and Midwestern projects and among power, locks and dam projects. What perhaps is most clearly shown in these Tables is the relatively narrow range within which the previous unemployment status of the workforce occurs under a variety of disaggregations. The confounding effects of project type on geographical area are not explored at this time, nor are the possible effects produced by differences in locality and occupational composition of the workforce. These analyses are pursued more completely in the following section which examines variation among the individual projects surveyed.

2.2.4 Seasonality and Employment Status

Previous unemployment of the workforce can be produced by seasonal, frictional, cyclical and structural forces. Seasonal forces have been identified as producing a significant amount of unemployment in the construction industry. Since seasonal forces have nothing to do with structural causes of unemployment which the WRC benefits are intended to address, it is important to see if a seasonal component in the unemployment figures obtained can be identified.

The approach to test for seasonality employs the variable which measured when workers were hired on at the Corps project. Using this variable, a time-line beginning at the time of the survey and extending back a number of months can be constructed. For this test, the 12 months from July 1978 to June 1979 were used. The basic assumption to be employed in the test is that if there is a seasonal component to unemployment there should be seasonal variation observed in the previous unemployment of the workforce. Research has shown that construction unemployment peaks in February and is at its lowest in August (Department of Labor, 1979). It could therefore be anticipated that those workers hired onto a project in the winter months would have greater previous unemployment than those workers hired in the summer or fall. Such a difference becomes a rough approximation of the seasonal component of unemployment.

Table 2.5 shows previous unemployment of the workforce broken down by the month when workers began employment on the Corps projects. As can be seen, the months of December, January and February show higher percentages of unemployment than do other months.

Table 2.6 presents previous unemployment broken down by quarter in which workers began employment for the total sample and by region. The variation observed in the Table provides an approximate indicator of the influence of seasonal forces on Corps construction unemployment. It is likely that, of those workers hired in the winter of 1978-79 who had been unemployed, the season of the year may have been a factor in producing unemployment. In viewing unemployment for those workers hired in the autumn of 1978, however, it seems reasonable to conclude that seasonal factors such as inclement weather would not be an important factor in producing the unemployment observed. This lowest quarterly figure

Table 2.5. Previous Unemployment by Workforce by Month Hired

	1979 Jun	May	Apr	Mar	Feb	Jan	1978 Dec	Nov	Oct	Sep	Aug	Jul	Total
No. Workers Hired	685	551	295	193	95	67	33	63	96	136	114	264	2592
% Previously Unemployed	42.9	43.7	38.6	40.4	52.6	56.7	48.5	25.4	34.4	38.2	40.4	40.5	41.9

NOTE:
1,477 cases missing represent workers hired previous to Jul 1978.

Table 2.6. Previous Unemployment by Quarter Hired

Quarter Hired	Total		Region: South/Southeast		Midwest		Southwest/Great Plains		West	
	N	% Unemp	N	% Unemp	N	% Unemp	N	% Unemp	N	% Unemp
1979 2d (Apr-Jun)	1531	42.4	561	39.7	626	44.4	216	40.3	128	47.7
1st (Jan-Mar)	355	46.7	122	40.1	129	52.7	72	40.3	32	62.5
1978 4th (Oct-Dec)	192	33.9	35	40.0	63	27.0	66	36.4	28	35.7
3d (Jul-Sep)	514	39.9	165	43.0	215	43.3	68	29.4	66	31.8
TOTAL	2592		883		1033		422		254	
Amplitude		12.8		3.3		25.7		10.9		30.7
Average Amplitude[a]		8.4								

[a] Difference between Average Unemployment for Quarters 2, 1 and 3 and Unemployment for Quarter 4

could be used as a base-line representing unemployment produced by other-than-seasonal forces. If this assumption is made, seasonality can be factored out of the unemployment figures obtained.

As Table 2.6 shows, the amplitude of seasonal variation in previous unemployment for the total survey is 12.8 percent. This figure represents the effect of seasonality given the assumptions above. Since not all workers on a Corps project are likely to be hired during the first quarter, it seems reasonable to obtain an average amplitude of the average of the seasonal variation in unemployment of the workforce employed during the first three quarters and the unemployment of workers hired in the fourth quarter. The average unemployment for the three quarters amounts to 42.3 percent, making an average amplitude of 8.4 percent. Following the assumption employed above, it would appear that the previous unemployment totals obtained through the survey are overstated because of seasonal factors by 8.4 percent.

It is quite possible that seasonality may vary across occupational skill categories. It could be anticipated, for example, that white collar workers would be less subject to inclement weather and other seasonal factors. Table 2.7 presents previous unemployment broken down by occupational category and quarter in which workers began employment on Corps projects. As can be seen, both unskilled and skilled occupational categories show seasonal variation in previous unemployment while white collar workers do not. The average amplitude of seasonal variation of skilled and unskilled workers closely approximates the overall survey figure.

While Table 2.6 shows that projects in the Southeast and South did not display seasonal variation in unemployment, the fact that only one year was used to draw this conclusion should be kept in mind. It seems reasonable to expect that extended spring rains or other periods of inclement weather could introduce seasonal variation in this region as well. For this reason, it is felt that the average of seasonal variation from the total survey offers a useful estimate for projects located in the South and Southeast as well.

In summary, based on Tables 2.5-2.7 it would appear that the average figure of 8.4 percent could be applied to discount the effects of seasonal forces for unemployment totals obtained for unskilled and skilled workers for all Corps projects. Since white collar workers display very little seasonal variation, however, such discounting does not appear appropriate for this group of workers.

2.3 Projects

2.3.1 Introduction

The preliminary analysis of workforce characteristics suggests unemployment may be more closely associated with being a local and/or being in the unskilled occupational category. In

Table 2.7. Previous Unemployment by Quarter Hired by Occupational Category

	Quarter Hired	Unskilled		Skilled		White Collar	
		N	% Unemp	N	% Unemp	N	% Unemp
1979	2d (Apr-Jun)	363	46.3	957	43.2	196	31.6
	1st (Jan-Mar)	70	52.9	241	47.7	40	27.5
1978	4th (Oct-Dec)	47	38.3	115	33.0	30	30.0
	3d (Jul-Sep)	98	41.8	330	40.9	80	31.3
	Total	578		1643		346	
	Average Amplitude: [a]		8.0		10.4		NA

[a] Difference between Average Unemployment for Quarters 2, 1 and 3 and Unemployment for 4th Quarter.

addition, factors more prevalent in the West and Midwest and on power, locks and dam projects may also be associated with higher previous unemployment of the workforce. This section introduces several parametric tests of the relationships suggested above. In addition, project area characteristic variables are introduced in an effort to further clarify the pattern of employment status observed.

In the first part of this section the following hypotheses are evaluated:

(1) Previous employment status differs between locals and non-locals.

(2) Previous employment status differs among occupation groups.

(3) Previous employment differs by project type.

(4) Previous employment differs by geographical area.

(5) Previous employment differs by EDA designation of project.

The second part of this section introduces project area characteristic variables. To further clarify the pattern of variation observed in employment status, zero order product moment correlation coefficients between these variables and employment status variables are presented and conclusions drawn. Finally, several regression equations are presented which provide "best fit" solutions to the patterns of variation observed.

2.3.2 Dependent Variables

Variable names, definition, means and standard deviations for the dependent variables employed in project-level analyses are reported in Table 2.8. The variables represent the percent of workers in a particular category who reported some unemployment. Thus variable P1 is the percent of all workers at an individual project who reported being unemployed prior to taking a job on the Corps of Engineers Project. The base from which the percentage is computed eliminated "no answer" responses to the question about previous unemployment.

2.3.3 Previous Employment and Locality

Table 2.9 presents the tabulation of previous unemployment status for projects and for projects broken down by locality. The T-tests for differences in paired means provides clear evidence that local workers have higher rates of previous unemployment than non-local workers.

Table 2.8. Dependent Variables Used in Project-Level Analyses

Variable	Variable Description	Mean	S.D.
P1	Percent of workforce previously unemployed	38.6	14.0
P2	Percent of local workforce previously unemployed	41.4	15.5
P3	Percent of non-local workforce previously unemployed	27.3	17.6
P4	Percent of unskilled workforce previously unemployed	46.1	10.4
P5	Percent of skilled workforce previously unemployed	36.9	18.2
P6	Percent of white collar workforce previously unemployed	25.9	20.3
P7	Percent of unskilled local workers previously unemployed	46.7	23.7
P8	Percent of skilled local workers previously unemployed	39.8	20.2
P9	Percent of white collar local workers previously unemployed	28.0	26.2
P10	Percent of unskilled non-local workers previously unemployed	28.1	30.4
P11	Percent of skilled non-local workers previously unemployed	31.3	25.8
P12	Percent of white collar non-local workers previously unemployed	17.6	21.4

Table 2.9. Previous Unemployment and Locality

		Locality	
Previous Unemployment	Total (P1)	Local (P2)	Non-local (P3)
Mean	38.6	41.	27.3
Standard Deviation	14.0	15.5	17.6
Minimum	12.9	11.1	0.0
Maximum	100.0	100.0	100.0
N	50	50	50

† - test local unemployment/non-local unemployment
differences: means P2 - P3 = 13.7
T-Value 6.62
DF 49
Probability < .0001, one-tail

2.3.4 Previous Employment, Project Type and Geographic Area

The examination of workforce employment status performed in Section 2.1 revealed some association between employment status and the variables of project type and geographical area. This association disappears when viewing the variables aggregated by project. The analysis of variance tables presented in Table 2.10 produce F-values which indicate that there is not a statistical difference between the means.

2.3.5 Previous Employment and Occupational Group

Table 2.11 presents a tabulation of previous unemployment by the three occupational groupings. The analysis of variance tests indicated that the three distributions of previous unemployment are different from one another. It can be concluded that previous unemployment differs among skilled, unskilled, and white collar groups.

2.3.6 Previous Unemployment and Project Area EDA Status

Under the current regulations, employment benefits are restricted to projects located in EDA designated counties which have an approved redevelopment plan. These counties have been identified in recent Water Resource Council guidance (WRC, 1980), and are a subset of those counties declared eligible for EDA assistance. As described in PL 89 136 the Economic Development Administration is responsible for identifying counties with chronic and persistent unemployment problems. Since such EDA designated counties are selected on the basis of unemployment problems, it could be expected that the rate of previous unemployment among workers employed on projects located in EDA designated areas would be greater than the rate of previous unemployment among workers at projects in non-EDA designated areas. However, the presence or absence of an approved plan for combatting unemployment would appear to have little relationship to the amount of previous unemployment among the construction workforce. Water Resources Council guidance however suggests that there would be such a relationship and leads to the expectation that EDA areas with approved redevelopment plans would have greater previous unemployment.

Two hypotheses were therefore evaluated. First, that previous unemployment of the workforce on projects located in EDA designated areas is greater than that for workforces at projects located in non-EDA areas. Second, that previous unemployment of the workforce is greater at projects located in EDA areas with approved redevelopment plans than for projects located in EDA areas without such plans. Table 2.12 presents tests of these hypotheses. As can be seen the hypothesis that workforces on projects located in EDA-designated areas have more previous unemployment is supported. On the second hypothesis, however, there is no statistically significant difference in the value of previous unemployment of the workforce employed at projects located in EDA areas

Table 2.10. Previous Unemployment by Project Type, and Geographic Area

	Previous Unemployment	Project Type				
	Total	Flood Control	Reservoirs	Power	Channels/Harbors	Locks and Dams
a. Mean	38.6	39.2	36.4	34.4	36.9	46.6

b. Analysis of Variance for Above Data:

Source	Sum of Squares	DF	Mean Square	F-Ratio	Significance
Between Groups	566.2	4	141.5	.707	.59
Within Groups	9004.4	45	200.1		
Total	9570.6				

	Previous Unemployment	Geographic Area			
	Total	South/Southeast	Midwest	Southwest/Great Plains	West
a. Mean	38.6	38.0	39.0	38.5	39.6

b. Analysis of Variance for Above Data:

Source	Sum of Squares	DF	Mean Square	F-Ratio	Significance
Between Groups	13.7	3	4.6	.022	.996
Within Groups	9556.9	46	207.8		
Total	9570.6				

Table 2.11. Previous Unemployment of Occupational Groups

Previous Unemployment	Unskilled (P4)	Skilled (P5)	White Collar (P6)
a. Mean	46.1	36.9	25.9

b. Analysis of Variance for Above Data:

Source	Sum of Squares	DF	Mean Square	F-Ratio	Significance
Between groups	10297.2	2	5148.6	13.7	.001
Within groups	56613.1	147	385.1		
Total	66910.3	149			

Table 2.12. Previous Unemployment and Project EDA Status

a.

Previous Unemployment	Projects Located in EDA Area	Projects Not Located in EDA Area
Mean	39.9	33.4
Standard Deviation	15.0	7.1
N	40	10

t - test: difference in means - 6.5

T Value = 2.104

DF = 48

Probability = .026, one tail

b.

Previous Unemployment	Projects Located in EDA Area with Approved Redevelopment Plan	Projects located in other EDA Areas
Mean	42.5	38.0
Standard Deviation	19.5	10.6
N	17	23

t - test: difference in means - 4.5

T Value = .95

DF = 38

Probability = .175, one tail

with approved redevelopment plans and those located in other EDA areas.

It is also important to note that although unemployment in non-EDA areas is less than that in EDA areas, it is by no means trivial. By computing a standard error of the mean for non-EDA unemployment it can be seen that it is extremely unlikely that the value of such unemployment is equal to zero. With the standard error equal to 2.08, there is a 99 percent chance that the true mean of unemployment in non-EDA areas is within $\pm$ 3 standard errors of the sample mean, i.e. 33.4 $\pm$ 6.1.

While EDA areas are designated on the basis of structural economic problems it is likely that almost every local economy will have some structual problems and a pool of individuals who are out of work because of such imperfections. Data from this summary indicate that unemployment among construction in workers in non-EDA areas is substantial. This finding calls into question the rule restricting employment benefits to certain EDA areas.

2.3.7 Summary

Based on the above analyses, the following conclusions about employment status can be made:

(1) The local workforce has a higher rate of previous unemployment than the non-local workforce.

(2) Previous unemployment varies according to occupational group, with unskilled groups exhibiting the highest rate, white collar the lowest, and skilled an intermediate rate.

(3) There does not appear to be a statistically significant systematic variation between previous unemployment by project type or by geographic area in which the project is located. Several interpretations are available for these findings: (a) The constructed geographic area variables may have little or no relation to actual, historically formed social or economic regions; (b) The factors which are associated with previous unemployment are distributed with regard to geographic region in such a way that the variation of these factors within regions is as great as any differences occurring among regions; (c) Hypothesized linkage between project types, skill distribution and previous unemployment does not exist. Under this hypothesis it could be expected that project types would have different skill distribution which in turn produce different rates of previous unemployment for projects. Since, however there is a great deal of internal variation of occupation distributions within project type groups, project type does not appear to be a useful classificatory variable for examining the previous unemployment status of the workforce.

(4) EDA designated areas have higher rates of previous unemployment than do non-EDA designated areas; however previous

unemployment among the Corps workforce in non-EDA areas is substantial.

2.3.8 Correlation Analysis

Fortunately, the analysis can proceed beyond a consideration of nominal scale variables. This section introduces project area variables into the analyses. These metric scale variables allow the inspection of project workforce patterns of variation with considerably more detail. The analysis proceeds with an inspection of simple product moment correlation between employment status variables and project area characteristics. Regression equations are then developed using variables identified in the correlation analysis. These equations are evaluated for their goodness of fit to the existing data.

a. Previous Unemployment (Variable P1)

Table 2.13 presents a compilation of project area variable correlations with the various dependent variables measuring project level workforce unemployment. It can be seen that most correlations are quite modest. Several variables have somewhat higher correlation coefficients, however. These include: the laborshed unemployment rate (.541); project area unemployment rate (.452); EDA County (.188); distance to nearest SMSA (.168) and local area population 1975 (.160).

The interpretation of these relationships seems fairly straightforward. EDA areas are designated on the basis of chronic or persistent unemployment. Projects located in these counties would be expected to tap more heavily a labor pool that had been previously unemployed. The strong association between both laborshed and project area unemployment rates and previous unemployment of the project workforce can be interpreted in similar fashion. In viewing the relationship between distance to SMSA and previous unemployment, it could be assumed that projects located greater distances from metropolitan areas would draw more heavily on local workforces which, as has been shown, have higher previous unemployment rates than non-locals.

b. Skill Categories (Variables P4-P6)

When previous unemployment is disaggregated some of the relationships discussed previously become clearer. Variables associated with previous unemployment of unskilled workers (Variable P4) are: SMSA (.351); project area unemployment (.358); and Labor Shed Unemployment (.391). For skilled workers (Variable P5) previous unemployment is associated with the following variables: population of the local area for both 1970 and 1975 (.200, .193); the labor force size (.202); project area unemployment (.392); and the labor shed unemployment rate (.468). For the white collar group, previous unemployment (Variable P6) is associated with the EDA status of the project (.296) and the labor shed unemployment rate (.481); and the project area unemployment rate (.384).

Table 2.13 Correlation Coefficients - Previous Unemployment

Dependent Variable	Independent Variables[1] POP70	POP75	UNE79	CON77	LAB70	SMSA	EDA	EDUC	DEN75	CIT25	INC75
Percent Unemployed (P1)	.152	.160	.452	.112	.154	.168	.188	.040	.038	.028	-.063
Percent Unskilled Unemployed (P4)	-.045	-.018	.358	-.060	-.042	.351	.086	.016	-.076	-.013	-.099
Percent Skilled Unemployed (P5)	.200	.193	.392	.130	.202	.037	.14	-.028	.133	.097	-.045
Percent White Collar Unemployed (P6)	.098	.075	.384	-.067	.094	.139	.296	.122	.041	.038	-.077
Percent Local Unskilled Unemployed (P7)	.052	.082	.251	.212	.064	.331	-.037	.024	-.027	.033	-.059
Percent Local Skilled Unemployed (P8)	.187	.188	.362	.111	.286	.009	.238	-.000	.090	.099	-.057
Percent Local White collar Unemployed (P9)	-.046	-.048	.413	-.136	-.058	.199	.268	-.231	-.048	-.030	-.368
Percent Non-Local Unskilled Unemployed (P10)	.155	.167	-.093	.076	.158	-.046	.058	.003	-.066	.067	.082
Percent Non-Local Skilled Unemployed (P11)	.081	.080	.193	.102	.088	.003	-.029	-.024	.010	-.113	-.029
Percent Non-Local White Collar Unemployed (P12)	.109	.097	-.104	-.004	.123	.051	.131	.263	.054	.016	.208
Mean	455243	478302	5.9	10729	16751	26.8	.8	10.9	229.4	6.6	5084
Standard Deviation	720008	806311	2.7	21905	273867	30.8	.4	1.4	539.5	11.8	1043

Dependent Variable	LPOP70	LPOP75	LUNE79	LCON70	LLAB70	LEDUC	LDEN70	COST	PERC	EMPTOS	SUNBDE	CTRLL	PEAK
Percent Unemployed (P1)	-.128	-.115	.541	-.100	-.123	-.003	-.101	.14	.039	.141	-.111	-.131	.111
Percent Unskilled Unemployed (P4)	-.132	-.111	.391	-.064	-.121	.002	-.147	.116	.113	.093	-.192	-.135	.099
Percent Skilled Unemployed (P5)	-.028	-.025	.468	-.028	-.028	-.050	.016	.160	.005	.169	-.000	.011	.149
Percent White Collar Unemployed (P6)	.029	.019	.481	-.027	.025	.095	.116	-.052	.006	.034	-.174	.099	.024
Percent Local Unskilled Unemployed (P7)	-.089	-.065	.283	.009	-.078	-.009	-.217	.150	.111	.133	-.011	-.141	.106
Percent Local Skilled Unemployed (P8)	-.043	-.035	.457	-.033	-.041	0.045	-.034	.170	-.037	.156	-.084	-.021	.145
Percent Local White collar Unemployed (P9)	-.058	-.060	.492	-.092	-.071	-.188	-.048	.132	.053	.223	-.135	1.173	[illegible]
Percent Non-Local Unskilled Unemployed (P10)	.036	.061	-.068	.125	.035	.031	.202	.141	.151	.215	.273	.297	.290
Percent Non-Local Skilled Unemployed (P11)	-.108	-.108	.191	-.110	-.117	.012	-.007	.059	.123	.119	.200	.026	.124
Percent Non-Local White Collar Unemployed (P12)	-.072	-.070	-.077	-.075	-.067	.176	.057	-.031	.093	-.033	-.016	.101	.094
Mean	1305381	1379101	5.4	30330	473739	11.1	116.2	176.1	62.5	124.4	964.5	.30	228.2
Standard Deviation	1600676	1676117	2.2	35769	618738	1.2	131	319	25.2	201.8		.46	293.8

[1] refer to section 1. for variable description and measurement procedures.

It is clear that the association between project workforce previous unemployment and distance to SMSA is mostly accounted for in the unskilled labor category. For the other occupational categories, the association noted is not present (r SMSA - P5 = .037; r SMSA - P6 = .139). The pattern of these associations suggests the following interpretations: (1) The unskilled workforce in remote areas is more marginal or less well-qualified than the unskilled workforce closer to metropolitan areas; or (2) there are fewer job opportunities in remote areas for the unskilled labor force as compared to metropolitan areas.

The positive association between project area population size variables and skilled unemployment suggested that more populous areas may have a larger pool of skilled labor, a larger part of which is more likely to be unemployed than in areas where skilled labor is more scarce. If this were the case, it could be expected that the positive relationship noted would be more apparent for the local skilled workforce than for the non-locals. This, in fact is the case. (r P8 - POP70 = .187; r P11 - POP70 = .081)

c. Skill Levels and Locality (Variables P7 - P12)

Skill levels can be further disaggregated on the basis of the locality of workers. By doing so, the associations between the unemployment of local and non-local skill groups and other variables are further clarified. In viewing the correlations for the occupation groups disaggregated on the basis of locality, it becomes clear that most of the association previously noted pertains to local workers rather than non-local workers. By separating the non-locals from the locals the previously noted correlations are increased for the local occupational groups. It is interesting to note that the white collar local and non-local group appears to have two variables which have cancelled one another out. When considered at the aggregated level for white collar locals, previous unemployment is associated negatively with an area's educational and income status (- .231, - .368). While for non-local white collar groups previous unemployment is associated positively with education and income (.263, .208).

Both skilled and white collar local previous unemployment (Variables P8 and P9) show association with a project areas' EDA status (r = .238 and .268 respectively). No such association is present for local unskilled workers.

Projects which have higher rates of local white collar unemployment are located in areas of lower overall educational attainment and lower income. This suggests that these areas may have more limited employment opportunities for many kinds of white collar jobs. Previously unemployed white collar non-locals on the other hand seem more attracted to areas of higher average educational attainment. Non-local unskilled workers seem to be affected by the level of regional construction activity measured by variables SUMBDE and SUMV. Previous unemployment among local unskilled workers shows no association with regional construction

activity (r P7 - SUMBDE = -.011); while non-local unskilled unemployment is positively associated (r P10 - SUMBDE = .273). Although no definitive explanation is possible, it seems plausible that the positive relationship noted between non-local unskilled unemployment and regional activity may be due to the migration of unskilled workers from regions with less construction activity into areas with a higher volume of construction activity and consequently a greater demand for unskilled labor.

d. Summary

From the correlation analysis it can be concluded that:

(1) Associations largely pertain to the local workforce. The local and regional characteristic variables account for very little variation in non-local unemployment experience.

(2) The local unskilled workforce is more likely to have been previously unemployed in more remote areas. This not true for skilled and white collar groups.

(3) The local skilled and white collar workforce is more likely to have higher proportions of previous unemployment in EDA areas. This is not true for unskilled locals. This suggests that unskilled unemployment is more uniformly distributed than skilled and white collar unemployment.

(4) Laborshed unemployment has the strongest overall relationship with all local skill groups previous unemployment.

These findings suggest that there are different sets of dynamics operating for different parts of the workforce in producing previous unemployment.

For local workers previous unemployment among unskilled workers is associated with remoteness from areas of economic activity. For skilled and white collar groups previous unemployment seems to be related to an ensemble of socio-economic factors which give a region a less competitive edge. These socio-economic conditions are proxied in this analyses by EDA designation, average educational attainment, and average per capita income.

The previous unemployment of non-local groups appears to be associated with the attractiveness of a region. For unskilled non-local workers this attractiveness is expressed as general level of construction activity in a region. The greater the construction activity the more job opportunities for unskilled labor are likely to be present. White collar workers seem more attracted by areas having a desirable standard of living as represented by higher average education and income levels. For the skilled non-local workforce previous unemployment does not appear to be associated with any of the above factors.

2.3.9 Regression Analysis

Table 2.14 presents regression equations estimating dependent variables for overall workforce previous unemployment, as well as for previous unemployment for unskilled, skilled, and white collar groups. The introduction of project area variables simultaneously allows the interaction effects of variables to be inspected. For the regression analysis a forward stepwise procedure was employed.

The equations make it clear that the laborshed unemployment rate is the strongest predictor of previous unemployment among the workforce (Variable P1). For each one point increase in the laborshed unemployment rate there is a 3.4 point increase in the value of Variable P1. The effect of this variable, however, differs markedly by occupational group. Skilled and white collar workers are much more affected by the regional unemployment rate than are unskilled workers. A one point increase in the regional unemployment rate translates into almost a 3 point increase in unskilled employment but 5.6 and 4.6 point increases in unemployment for skilled and white collar workers respectively.

As the correlation analysis indicated previously, remoteness is a significant predictor of unskilled unemployment (equation b). Each additional mile a project is located away from the nearest SMSA produces a two-tenths of one percent increase in unskilled unemployment.

All coefficients for equations a, b, and d are statistically significant at least at the .95 level. For equation c, two of the 5 coefficients were significant, while 3 have "t" values which fail to reject the null hypothesis that the coefficient's value equals zero. Coefficients of determination (R^2) for the equations range between .32 and .39. These R^2 values represent a reduction of errors in predicting the dependent variable of 32 to 39 percent compared with the size of errors made using the mean value of the dependent variable as the predictor. Clearly there are other factors operating to produce the variation in the dependent variables which these equations do not capture. Standard errors for the regression equation are sufficiently large to impair the utility of the equations to estimate previous unemployment. For a given estimate of overall previous unemployment (Variable P1), the 95 percent confidence interval around the estimate would be $\pm$ 22.5. Thus if the predicted value of Variable P1 were 40 percent, the 95 percent confidence interval would be 17.5 - 62.5.

2.3.10 Test of Models

The process of ordinary least squares regression will always result in some improvement in ability to explain the variation in data which were used to fit the regression line over and above the explanation provided by the mean and variance of the data. In practical applications of regression analyses for predictive purposes it is seldom likely that the exact combination of variable values used to devise the original equation will be encountered.

Table 2.14. Regression Equations: Previous Unemployment Independent Variables
(Metric Coefficients)

Dependent Variables	Laborshed Unemployment Rate (LUNE 79)	Distances from SMSA (SMSA)	Competing Projects in BEA (SUMBDE)	Local Area Population 1975 (POP 75)	Laborshed Construction Force 1970 (LCON 4)	Laborshed Population 1975 (LPOP 75)	Laborshed Laborforce 1970 (LLAB70)	Local Area Laborforce 1970 (LAB70)	Total Employment at Time of Survey Transformed LN(EMPTOS)	EDA Area (EDA)	Local Area Education (EDUC)	Constant	R^2	F	Standard Error
a. Proportion Previously Unemployed (P1)	3.451 (4.7)			.0000065 (2.6)			-.0000068 (-2.1)					20.08	.39	9.86	11.25
b. Proportion, unskilled	2.998 (2.5)	.203 (2.1)	-.007 (-2.7)		.001 (3.4)	-.00027 (-3.3)						26.93	.38	5.45	16.91
c. Proportion, skilled previously unemployed (P5)	5.604 (4.3)	-.117 (-1.3)						.000014 (1.5)	4.89 (2.2)	-9.913 (-1.5)		-4.92	.37	5.09	15.24
d. Proportion, white collar previously unemployed (P6)	5.189 (4.4)										4.25	-48.49	.31	10.33	17.23

"t" values in parentheses. At .95 level probability that coefficient ≠ 0 - 2.0, two-tail, 49 degrees of freedom.

As a predictive tool using data not used in determining the regression line it may or may not be true that the equation offers an improvement in explaining variation in the data.

It would be helpful, therefore, if the power of regression equations developed in 2.3.8 could be tested on data not included in the computation of the equations. To accomplish this, data on previous unemployment from seven projects from the North Atlantic and New England divisions which were collected in the survey pretest are compared with predictions generated by the regression equations, as well as with estimates made using the means from the national survey data.

Table 2.15 presents these comparisons. Part A of the Table shows that the actual overall percent of workers reporting previous unemployment at the Yonkers Flood Control project was 60.0. Regression equation "a" derived in Section 2.3.8 generated a prediction of 36.4 percent; while the mean overall percent previously unemployed derived from the national survey was 39.6. Deviations of these predictions from the actual value were computed and squared. For example, for the Yonkers project:

*Actual - predicted by regression a; squared:
$60 - 36.4 = 23.6^2 = 556.96$
*Actual - predicted by mean; squared:
$60 - 39.6 = 20.4^2 = 416.16$

This Table shows that the means obtained from the national survey provide better estimates of previous unemployment than do the regression equations for projects not included in the regression analysis. The results reported in Table 2.14 suggest that the regression equations may have some limited value for "first-cut" approximations. However, estimates provided by the means of the national survey are likely to offer predictions that are as accurate as those produced by the equations, besides offering the advantage of no need to go through involved data collection or computation procedures.

2.4 Developing Refined Estimates of Workforce Unemployment

The Tables obtained from the survey may offer a means for estimating employment benefits. Two issues must be addressed. First is the issue that the unemployment totals for the occupational categories represent unemployment produced by other than structural forces. It has already been shown that there is a seasonal component in the figures; it is also likely that there are discretionary and frictional components as well. The discretionary component refers to "voluntary unemployment" among

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*Total squared deviations for the seven projects were summed for each regression equation, and each mean value. An "average" squared deviation was then computed by dividing the summed values by the number of projects.

Table 2.15. Model Test Using Projects Measured in Pretest

Previous Unemployment

	a Total Percent Unemployed			b Percent Unskilled Unemployed			c Percent Skilled Unemployed			d Percent White Collar Unemployed		
	Actual	Equation a	Mean	Actual	Equation b	Mean	Actual	Equation c	Mean	Actual	Equation d	Mean
Yonkers Flood Control	60.0	36.4	39.6	75.0	0	46.3	69.2	39.3	41.9	0	33.6	26.1
Potomac Estuary	45.0	37.3	39.6	40.0	32.6	46.3	46.7	38.2	41.9	0	31.2	26.1
Bloomington Lake	47.0	48.7	39.6	52.4	51.0	46.3	49.4	55.7	41.9	33.3	43.1	26.1
Blue Marsh	39.7	26.0	39.6	61.9	27.3	46.3	29.8	49.8	41.9	37.5	31.3	26.1
Cowanesque Lake	50.0	41.6	39.6	58.5	53.8	46.3	50.5	47.0	41.9	31.6	36.7	26.1
Tioga-Hammond Lake	45.7	42.6	39.6	46.9	56.1	46.3	46.2	44.6	41.9	36.4	36.6	26.1
Park River, CN	52.3	32.5	39.6	52.2	25.8	46.3	58.9	37.7	41.9	0	29.2	26.1
Sum of squared deviations, i.e. (actual values - predicted values)^2		1278.7	807.0		7682.7	1328.0		1870.3	1352.5		3115.5	2361.8
Mean squared deviation		182.7	115.3		1097.5	189.7		267.2	193.2		445.1	337.4

construction workers, wherein some workers may become unemployed for a limited amount of time to pursue hobbies or relax.

Frictional unemployment is a by-product of the nature of the construction process itself. When a project begins, a workforce is assembled; when the project is complete the workforce is dismissed. This process generates spells of unemployment for workers as they look for new projects. As with seasonality, both discretionary and frictional unemployment have nothing to do with structural causes of unemployment and so must be factored out of any estimate of unemployment for use in employment benefit calculations.

The most appropriate way of factoring out frictional and discretionary components of unemployment is to establish a more stringent definition of unemployment. Only those individuals reporting a minimum number of days of unemployment would be classified as unemployed. Following this approach, the issue becomes one of deciding what should constitute a minimum number of days to define unemployment. In the survey, workers were asked to report the number of days they were unemployed in the six weeks preceding their employment on the Corps projects, so the number of days for setting a minimum standard ranges from 1 to 30.

For this study, those workers reporting 11 or more days unemployment are defined as unemployed. This minimum was established for two reasons. First, it seems that periods of unemployment of two weeks or less are more likely to be associated with discretionary "vacations" or with temporary transitions between projects than are periods of greater than two weeks. In addition, a previous study (Thompson and Sulvetta, 1975) defined unemployment as being out of work a minimum of two weeks.

The second issue concerns making use of information obtained in the analyses employed in this Chapter to refine the unemployment figures presented in the Table. Differences in unemployment have been found to be associated with EDA status of project areas, the locality of the workforce and with the regional unemployment rate. In the analyses pursued above, the regional unemployment rate was a metric variable. However, it is possible to make it an ordinal variable by breaking it into categories. It becomes a matter of discretion as to what criterion should be selected to make categories. For this study it seemed reasonable to employ the same criterion as that used in Public Law 89-136. This law, establishing the criteria for determining EDA areas, defined areas with unemployment of 6 percent or greater as having "substantial" unemployment (Section 401). Therefore, a simple dichotomous variable was created for regional unemployment placing projects located in regions with less than 6 percent unemployment in April 1979 into a "low" category, and projects located in regions with 6 percent or greater unemployment into a "high" category.

The variables of locality, EDA status, and regional unemployment can be used to decompose the general table of unemployment figures presented in Table 2.1. Using these dichotomous variables, eight tables can be generated as follows:

a. Local unemployment in EDA areas with high regional unemployment.

b. Local unemployment in EDA areas with low regional unemployment.

c. Local unemployment in non-EDA areas with high regional unemployment.

d. Local unemployment in non-EDA areas with low regional unemployment.

Tables a-d can be repeated substituting "non-local" in place of local to yield the entire eight table array. In fact, only six tables could be created; there were no cases in the survey involving non-EDA areas with reigonal unemployment of 6 percent or greater.

Table 2.16 presents the six tables generated. The unemployment figures for all tables have been deflated to remove discretionary and frictional unemployment. As can be seen, there are differences among the unemployment figures by occupational categories among the tables which correspond to the general findings of the analysis.

Decomposing the general table produces tables with small numbers whose stability and meaning is open to question. A procedure needs to be employed to gauge the significance of the values obtained. The z-test of proportions is employed to test whether the differences between unemployment values differ from one another.[1] For the test, a one-tailed level of significance is employed since directionality is assumed in the hypothesis evaluated.

The testing procedure performed was as follows:

Within a specific occupational category differences produced by EDA status were tested. If the test was not significant, separate tests were performed for tables where unemployment was decomposed on EDA status, and on regional unemployment. When a test yielded a Z value which was significant, the table values were kept; in cases where the tests were not significant, the tables were collapsed backward into higher levels of aggregation ending finally back at the values established in the general survey.

This procedure is illustrated below using unskilled and skilled unemployment:

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1. The z-test assumptions and procedures are described in *Chapter 1*.

Table 2.16. Previous Unemployment Decomposed by EDA Status, Locality and Regional Unemployment

Total Survey

	Unskilled	Skilled	White Collar
%	40.4	34.5	22.1

Tot. N = 3910

Missing = 179

Locals

	EDA Areas Unskilled	EDA Areas Skilled	EDA Areas White Collar	Non-EDA Areas Unskilled	Non-EDA Areas Skilled	Non-EDA Areas White Collar
High Regional Unemployment %	51.1	41.2	29.7			
Number Unemployed	95	245	19			
Low Regional Unemployment %	39.7	34.9	30.4	35.9	29.3	18.2
Number Unemployed	165	358	48	23	53	8

Non-Locals

	Unemployment	EDA Unskilled	EDA Skilled	EDA White Collar	Non-EDA Unskilled	Non-EDA Skilled	Non-EDA White Collar
High Regional Unemployment	%	30.4	31.2	19.8			
	Number Unemployed	17	73	19			
Low Regional Unemployment	%	34.0	27.8	15.3	31.8	33.0	15.7
	Number Unemployed	33	101	24	7	33	6

* Previous Unemployment has been defined here as 11 or more days of unemployment.

(1) Z-test of unskilled local unemployment EDA areas, high versus low regional unemployment

H_1 51.1% > 39.7%

Z value = 1.78

Z value necessary to accept H_1 at .05 level, one tail = 1.65

therefore accept hypothesis

(2) a. Z-test of <u>Skilled</u> local unemployment EDA areas, high versus low regional unemployment

H_2 41.2% > 34.9%

Z value = 1.54

Z value necessary to accept H_2 = 1.65, therefore reject H_2

b. Z-test of skilled local unemployment by regional unemployment

H_3 41.2 > 34.1

Z - value = 1.825

Accept H_3. The difference between the outcomes of 2a and 2b are largely due to an increase in raw numbers obtained by collapsing the EDA variable.

The testing procedure resulted in Table 2.17 part a. The unemployment values have been further deflated in Part b of the Table to remove seasonal unemployment. The resulting values represent estimates of previous unemployment of various segments of the Corps workforce.

2.5 Summary Findings

This Chapter began with several questions concerning the employment status of the Corps workforce. This section summarizes what answers to these questions the analyses have provided.

2.5.1 What is the Employment Status of the Corps Construction Workforce?

Of 4089 workers responding to the question, 39.6 percent reported some unemployment immediately prior to beginning work on Corps projects. The duration of previous unemployment averaged four and one-half weeks out of 6 possible weeks.

Table 2.17. Previous Unemployment Estimates

a. Previous Unemployment

	Local Workers		
	Unskilled	Skilled	White Collar
EDA areas with high regional unemployment	51.1	41.2	22.1
EDA areas with low regional unemployment	40.4	34.1	22.1
and			
Non EDA areas			
	Non-local Workers		
All areas	40.4	29.7	22.1

b. Previous Unemployment with Seasonality Removed

	Local Workers		
	Unskilled	Skilled	White Collar
EDA areas with high regional unemployment	42.7	32.8	22.1
EDA areas with low regional unemployment	32.0	25.7	22.1
and			
Non EDA areas			
	Non-local Workers		
All areas	32.0	21.3	22.1

2.5.2 Does Employment Differ According to Occupational Group, Locality, Region, Project Type, or a Project Area's EDA Status? Does Employment Status Show Seasonal Variation?

Clear differences in employment status were found among the workforce according to occupational group, locality, and project area EDA status. Employment status showed no association with region or type of project. Unskilled workers are more likely to have been previously unemployed than skilled or white collar, and skilled workers have higher rates of previous unemployment than the white collar workforce. Local workers have higher rates of previous unemployment than do non-local workers. Projects located in EDA areas have higher rates of workforce previous unemployment than do projects located in non-EDA areas. A seasonal component of unemployment was computed for the unskilled and skilled occupational categories.

2.5.3 Can Some of the Factors Which Account for Construction Unemployment be Identified?

Findings suggest that different factors are associated with previous unemployment for unskilled, skilled, and white collar segments of the workforce. For unskilled workers remoteness of the project area as well as the general level of construction activity are associated with previous unemployment. For skilled and white collar groups previous unemployment is related to an ensemble of socioeconomic factors which give a region a less competitive edge; examples of these factors include EDA designation, average educational attainment, and per capita income. For all occupational groups the regional unemployment rate was strongly associated with previous unemployment.

2.5.4 Can Ways of Estimating Previous Unemployment in the Construction Workforce be Developed for Use in Calculating Employment Benefits?

Regression equations were developed for project data. These equations explained from 31 to 39 percent of the variation in the variables of previous unemployment. In testing these equations against other data generated in the survey pretest it was determined that predictions generated by the mean from the national survey were superior to those made by the regression equations. This finding, coupled with the necessity for data collection for employing the regression equations suggest that the means of previous unemployment for occupations groups offer a useful and simple method for estimating previous unemployment.

Adjustments for seasonal, discretionary and frictional unemployment were made to the unemployment totals. Table 2.17, generated by decomposing the national survey table, offers a more refined estimate of previous employment than that provided by the general table.

CHAPTER 3

LOCALITY OF THE WORKFORCE

3.1 Introduction

Corps of Engineer construction projects, of course, produce positive as well as negative social effects. However, it is the disruptive (negative) social effects associated with construction projects which present a challenge to Corps of Engineers planners charged with the implementation of plans. An increasingly sophisticated and articulate public is making it more and more in the Corps' interest to help local governments manage and mitigate disruptive social effects of construction activities. Preliminary efforts in this direction can be seen in the development of methodologies for performing "community impact assessments." (See Chalmers, forthcoming). Such assessments systematically identify the magnitude of local social service demands created by the influx of a construction workforce (cf. Harnisch, 1980).

Requisite to performing a community impact assessment, is estimating the size of the population influx that the construction project will produce. This Chapter presents information on a key component of population increase due to construction -- the proportion of non-local[1] workers employed on Corps projects. Chapter 4 continues the analysis focusing on the other primary component of population increase -- the number of dependents accompanying non-local workers into local areas.

This Chapter, then, addresses the following questions:

(1) What is the locality of the Corps workforce?

(2) Does locality vary according to occupational group, geographic region, or stage of completion of project?

(3) What factors are associated with the proportion of non-local workers employed on Corps projects?

(4) Can estimating techniques be developed to predict the number or proportion of non-local workers employed on Corps projects?

3.2 Workforce

Table 3.1 presents a breakdown of the locality of the workforce. As can be seen, the Corps workforce is primarily composed of local workers. Tables 3.2, 3.3 and 3.4 examine the workforce according to occupational group, project type, and geographical

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[1]Non-local is an attribute of the variable locality. The variable and its measurement process is described in Section 1.3.

Table 3.1. Locality of the Workforce

Locality	Workforce	
	N	(%)
Local	2839	(69.4)
Non-Local	1212	(29.6)
No Answer	38	(0.9)
	4089	(100.0)

Table 3.2. Locality and Occupational *Group*

Locality	Unskilled (%)	Skilled (%)	White Collar (%)
Local	685 (79.2)	1850 (72.3)	267 (49.6)
Non-Local	180 (20.8)	708 (27.7)	307 (53.5)

Missing Cases: 92

Table 3.3. Locality and Project Type

	Project Type				
Locality	Flood Control	Reservoir	Power	Channel-Harbor	Locks and Dam
Local	580 (69.8)	575 (66.6)	385 (73.3)	144 (68.9)	1155 (71.2)
Non-Local	251 (30.2)	288 (33.4)	140 (26.7)	65 (31.1)	468 (28.8)

Total = 4051

Missing Cases = 38

x^2 = 8.6, significance = .07

Table 3.4. Locality and Geographical Area

Locality	Geographical Area							
	South & Southeast		Mid-West		Southwest-Great Plains		West	
	N	(%)	N	(%)	N	(%)	N	(%)
Local	1040	(70.9)	1213	(74.5)	274	(66.0)	312	(57.6)
Non-Local	426	(29.1)	415	(25.5)	141	(34.0)	230	(42.4)

Total = 4051

Missing Cases = 38

$x^2 = 59.5$, significance = .0001

area, respectively. Table 3.2 indicates that unskilled and skilled workers are much more likely to be drawn from the local area compared with the white collar occupational group.

Table 3.3 shows very little association between locality of the workforce and the type of project that is being constructed. As might be expected, however, the region of the country shows some association with locality (Table 3.4). According to this Table, the proportion of the workforce which is non-local is greater in the western part of the United States. The lower population densities and greater distances between centers of population in the West make such a finding intuitively plausible. Derivatively, it could be hypothesized that projects that are relatively isolated or remote would have higher proportions of non-locals employed.

In summary, the analysis of locality of the workforce suggests the following:

(1) The majority of the Corps workforce is composed of local workers.

(2) White collar workers are more likely to be non-local than other occupational groups.

(3) The proportion of non-local workers in the workforce is likely to be higher in the Western United States.

(4) The proportion of non-local workers is likely to be higher for projects located in remote areas.

3.3 Comparison with Other Studies

Table 3.5 compares locality of the Corps workforce with locality as measured in other construction worker studies described in Chapter 1. As can be seen the Corps of Engineers findings are most similar to the TVA data. The findings of the WPRS and North Dakota studies apply to projects located in the Western United States and consequently have higher percentages of non-locals. Comparing Table 3.4 to these latter studies it can be seen that the percentage of non-locals for Corps projects in the West are much more similar to the WPRS and North Dakota findings.

3.4 Projects

3.4.1 Locality, Occupational Group, Geographical Region

Table 3.6 presents descriptions of the variables used in the analysis of project-level workforce locality. At a project unit of analysis the relationships noted in Section 3.2 are generally affirmed. Table 3.7 presents the locality of the project workforce overall and broken down by occupational group. There are substantial differences among non-local proportions of occupational groups. Table 3.8 examines the variable of recent non-local

Table 3.5 Comparisons with Other Construction Worker Surveys: Locality of Workforce

Locality	IWR	WPRS	Battelle	TVA	North Dakota
Local (%)	69.4	47.2		71.4	50.0
Non-Local (%)	29.6	52.8	17-34[a]	28.6	50.0

[a] 75 percentile range, i.e. range within which 75 percent of surveys fell (28 surveys)

Table 3.6. Non-Local Workforce Dependent Variables

Variable	Description	Mean	Standard Deviation
NL1	Percent Non-Local Workers in Workforce	27.1	14.6
NL2	Percent Non-Local Unskilled Workers in Unskilled Workforce	17.8	19.3
NL3	Percent Non-Local Skilled Workers in Skilled Workforce	26.0	16.4
NL4	Percent Non-Local White Collar Workers in White Collar Workforce	45.9	29.9
NL5	Average Number of Non-Local Workers in Workforce	24.1	34.8

Table 3.7. Percent Non-Local in Project Workforce, Overall and by Occupational Groups

		Project Workforce	Occupational Groups		
		NL1	Unskilled NL2	Skilled NL3	White Collar NL4
Average Value (%)		27.09	17.8	26.0	45.9
Standard Deviation	14.6	14.6	19.3	16.4	29.9
Minimum Value	38.5	0.9	0.0	0.0	0.0
Maximum Value	100.0	61.5	100.0	63.2	100.0

Table 3.8. Percent Non-local in Project Workforce by Geographic Area

	(Total)	South-Southeast	Midwest	Southwest-Great Plains	West
Variable NL1	27.08	28.0	20.6	35.2	30.0
Standard Deviation	14.6	11.3	14.3	13.7	20.5
N	50	15	19	12	4

Analysis of Variance

	D.F.	Sum Sqs	Mean Sq	F	Prob
Between Groups	3	1645.15	548.38	2.88	.05
Within Groups	46	8762.99	190.50		
Total	49	10408.14			

(NL1) by geographic region. The interpretation that western areas have greater proportions of non-locals is supported.

Given the relationship noted between geographical region and locality, it was assumed that those projects located greater distances from urban areas would have higher proportions of non-locals employed. At the project level, this hypothesis is examined by looking at correlations between the percent non-locals employed at a project (Variable NL1) and the distance of the project from the nearest SMSA, and between percent of non-locals and the number of cities with populations of 10,000 or more within 25 miles of the project. Correlations for these relationships are modest but in the expected direction (r NL1 - SMSA = .172; r NL1 - CIT25 = -.183).

3.4.2 Locality and Stage of Project Completion

An important consideration in identifying community service impacts associated with the influx of construction workers is the phasing of construction activities and the size of influx. Some studies have noted that non-local construction workers appear to be first at project sites and, as projects near completion, the first to move on (TVA 1968). An alternative hypothesis is that non-locals form a more or less constant proportion of total employment over the life of the construction project.

Only a limited test of these hypotheses is possible because the survey represents a snapshot of projects at one point in time representing a particular stage of completion. Viewing these projects at different stages of completion as a continuum, however, it is possible to evaluate the character of the relationship in a very tentative fashion. Table 3.9 presents a tabulation of Variable NL1 by stage of project completion broken down into quartiles. The analysis of variance for the dependent variable indicate that the means are not different. Data do not support the hypothesis of a curvilinear relationship between stage of completion and percentage of non-locals present. It appears that the data provide somewhat stronger support for the view that a constant proportion of non-locals may be present over the life of the project. Again, the approach used to test these relationships should be kept in mind in evaluating these results.

3.4.3 Correlation Analysis

Table 3.10 presents a matrix of simple product movement correlations. The dependent variables considered in this analysis are: percent non-local (NL1); percent of unskilled workers who are non-local (NL2); percent of skilled workers who are non-local (NL3); percent of white collar workers who are non-local (NL4); and the actual number of non-local workers per project (NL5). Independent variables have been defined in Section 1.4.

As can be seen, the proportion of the workforce at projects which is non-local appears most closely associated with factors

Table 3.9 Percent Non-Local in Project Workforce by Stage of Project Completion

Analysis of Variance

	D.F.	Sum Sqs	Mean Sq	F	Prob
Between Groups	3	652.03	217.34	1.03	.39
Within Groups	46	9756.11	212.09		
TOTAL	49	10408.14			

Table 3.10. Correlation Coefficients, Locality and Independent Variables

Non-Local Dependent Variables	Independent Variables[a] POP70	POP75	UNE79	CON77	LAB70	SMSA	EDA	EDUC	DEN75	CIT25	INC75	LPOP70	LPOP75	LUNE79	LCON70	LLAB70	LEDUC	LDEN70	COST	PERC	EMPTOS	PEAK	SUNDUE
NL 1	-.151	-.116	-.024	-.028	-.141	.172	-.274	-.013	-.144	-.18	.080	-.339	-.317	-.253	-.259	-.328	.017	-.303	.158	-.172	.198	.147	-.081
NL 2	.082	.097	-.032	.274	.093	.001	-.124	.071	.023	-.073	.129	-.118	-.096	-.184.	-.018	-.112	.015	-.108	.152	-.057	.222	.201	.285
NL 3	-.283	-.241	.01	-.153	-.281	.351	-.267	-.062	-.319	-.277	-.053	-.386	-.367	-.155	-.323	-.374	-.014	-.453	.105	-.142	.124	.077	-.189
NL 4	.001	.008	.020	.138	.010	-.121	-.065	.035	-.01	-.17	.132	-.262	-.255	-.175	-.227	-.258	.003	-.252	.107	-.226	.068	.008	-.076
NL 5	-.153	-.14	.136	-.134	-.154	.278	.086	-.121	-.123	-.114	-.292	-.089	-.092	.043	-.100	-.100	-.257	-.146	.739	-.285	.956	.872	.13

a. Independent variables are described in Section.

which influence the region's ability to supply a pool of labor. For regions (laborsheds) with smaller populations, and consequently smaller labor forces, the proportion of non-locals is greater. Regions which have higher rates of unemployment and which are EDA qualified areas have a relatively greater pool of potentially employable locals. These variables also show modest negative association with the proportion of non-locals employed.

In breaking the non-local workforce down by occupational group, it can be seen that the skilled and white collar groups account for most of the association noted above. The explanation of the variation in unskilled non-local proportions does not appear to reside in any of the project area variables employed in this analysis. It should be noted, however, that unskilled workers make up a small overall percentage of the non-local workforce (see Table 3.1).

3.4.4 Regression Analysis

Table 3.11 presents regression equations for the dependent variable of percent of the workforce which is non-local (NL1) and for the variable of average number of non-local workers per project (NL5). For equation a, dummy variables for each of the four regions considered were also included. As can be seen the dummy variable for projects located in the Midwest (D2) had a statistically significant association with the dependent varible. The variable indicates that estimates of the proportion of non-local workers for projects located in the Midwest are reduced by 9.4 percent. The overall amount of variation explained by equation a is modest. Equations b and c, however, have R^2 values which are very high. Equation b uses total employment at the time of survey (EMPTOS) as a principle independent variable, while equation c uses the peak employment at the project (PEAK) instead of EMPTOS. It was felt that this latter variable may be more appropriate for projects which are still in planning stages. As the equation shows the fit of the regression line to the data is quite good.

An issue which needs to be addressed in developing an equation to estimate number of non-locals is the effect on non-respondents on such estimates. An average of 65 percent of workers responded to the questionnaire, leaving 35 percent who did not. Some proportion of this 35 percent were non-locals, and this proportion should be factored into any equations used to estimate non-local workers.

To address this issue a reasonable approach is to use the proportion of non-local workers in the group responding to the questionnaire on each project as a proxy for the proportion of non-local workers in the total workforce at the project. To check the reasonableness of this approach the proportion of non-local workers from projects with high response rates ($\geq$ 95%) were compared to the proportion of non-local workers from other projects. The resulting proportions could not be statistically distinguished from each other.

Table 3.11. Regression Equations: Non-Local Workers

Dependent Variables	Independent Variables: Metric Coefficients[1]								STANDARD	
	LPOP70	D2	LUNE79	PERC	EMPTOS	PEAK	CONSTANT	R^2	ERROR	F VALUES
a. NL1	-.000003	-9.347	-1.658				43.7	.29	12.7	6.29
b. NL5	-.000002			-.105	.162		12.7	.94	8.5	256.9
c. NL5	-.000002			-.329		.101	25.2	.83	14.8	74.9

1. All coefficients significant at .95 level or greater.

Using the approach presented above an estimate for total non-local workers and a simple regression equation using the variable of peak employment (PEAK) were produced (Table 3.12). The equation in Table 3.12 estimates numbers of non-local workers taking into account the influence of response rates.

3.5 Summary

The analyses presented in this Chapter provide the following answers to the set of questions posed in Section 3.1.

3.5.1 *What is the Locality of the Corps Workforce?*

A large majority of the Corps national construction workforce is composed of local workers (69.4 percent).

3.5.2 Does Locality Vary According to Occupational Group, Geographic Region or Stage of Project Completion?

White collar workers are much more likely to be non-local than either skilled or unskilled workers. Skilled workers are slightly more likely to be non-local than unskilled workers. Projects in the Western United States have higher proportions of non-locals employed than projects elsewhere in the country. Based on limited analysis it appears that the proportion of non-locals employed on a project remains constant over the course of the construction of the project.

3.5.3 What Factors are Associated with The Proportion of Non-Local Workers Employed on Corps Projects?

The proportion of the workforce at projects which is non-local is most closely associated with factors which influence a region's ability to supply a pool of labor. For regions with smaller populations the proportion of non-locals employed at a project is greater. Regions which have higher rates of unemployment and which are EDA qualified areas have a relatively greater pool of potentially employable local workers. These variables show modest negative association with the proportion of non-locals employed on a project.

3.5.4 Can Estimating Techniques be Developed to Predict the Numbers or Proportions of Non-Local Workers Employed on Corps Projects?

Regression equations were developed which predict the number of non-local workers employed on a project. The equations are likley to offer a useful means of predicting the number of non-local workers a project will employ.

Table 3.12 Estimated Non-Local Workers: Computed Variable and Regression Equation

Variable	Regression Dependent Variable	Peak	Constant	R^2	Standard Error	F Value
Numbers of Non-Local Workers Estimated (NLE)	NLE	.213[1]	-8.9	.78	33.4	171.7

Mean: 39.6

Standard Deviation: 70.6

Min: 0

Max: 353

---

[1] Coefficient significant at .99 level.

CHAPTER 4

NON-LOCAL WORKFORCE CHARACTERISTICS

4.1 Introduction

This Chapter focuses on several characteristics of the non-local workforce which may be important for anticipating the range and intensity of likely community service impacts associated with civil works construction projects. Specifically, the Chapter presents the following:

- The proportion of accompanied versus unaccompanied non-local workers.
- The average number of dependents accompanying non-local workers.
- The type of housing non-locals occupy.
- Locational preference factors for choosing the particular housing occupied by non-locals.
- Intentions of non-locals to remain in the local area after the construction project is completed.
- One-way distance commuted to work.

4.2 Accompanied/Unaccompanied Non-Local Workers

For the workforce as a whole, 59 percent[1] of those non-locals responding to the question, reported that they had dependents with them. Workers on projects in the West seem somewhat more likely to be accompanied than workers in the rest of the United States (Table 4.1). Workers in white collar occupations seem somewhat more likely to be accompanied than workers in other occupational groups (Table 4.2).

At the individual project level there are no relationships between the variable of accompaniment of non-local workers and project area characteristic variables with correlation coefficients greater than $\pm.20$.

4.3 Average Number of Dependents

Those workers that were accompanied brought an average of 2.11 dependents with them (Table 4.3). This figure can also be reported as a ratio of total dependents to total non-local

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[1]This question had substantial numbers of no response. The actual figures are: those reporting dependents present 493 (40.7 percent); no dependents present 344 (28.4 percent); and no answer 375 (30.9 percent).

Table 4.1. Accompaniment of Non-Local Workers

	Total		South & Southeast		Midwest		Southeast and Great Plains		West	
	N	%	N	%	N	%	N	%	N	%
Accompanied	493	(58.9)	169	(57.9)	178	(57.8)	89	(58.6)	57	(67.1)
Unaccom-panied	344	(41.1)	123	(42.1)	130	(42.2)	63	(41.4)	28	(32.9)

No Answer: 375

$x^2 = 2.6$, NS.

Table 4.2. Accompaniment and Occupational Status

	Unskilled N	Unskilled (%)	Skilled N	Skilled (%)	White Collar N	White Collar (%)
Accompanied	51	(56.7)	285	(54.8)	150	(69.8)
Unaccompanied	39	(43.3)	235	(45.2)	65	(30.2)

$x^2 = 14.3$ Significance = .0001

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Table 4.3. Accompanied Non-Local Workers: Average Number of Dependents

	N	Average	Stand. Dev.	Ratio to Total Non-Local[a]
Total Dependents	1040	2.11	1.33	1.24
Children	614 (59.0)[b]	1.24	1.26	.73
Ages:				
0-4	193 (31.4)	0.39		
5-12	231 (37.6)	0.47		
13-18	190 (40.0)	0.39		
	614 (100.0)			

a. Computed with denominator as total responding to question about accompanied status. (N = 837)

b. Percentages in parentheses

workers. For the workforce on the basis of only those non-local workers who responded to the question about dependents, this ratio is 1.24 dependents per each non-local worker. In Table 4.3 the category of dependents has been further disaggregated into children, and again subdivided into three age groups corresponding to pre-school, primary school and secondary school levels. As the Table shows, children made up 59.0 percent of total dependents. School age children (ages 5-18) made up 78 percent of total children. These figures indicate on the average for every 100 non-local workers coming into a project area, 124 dependents could be expected. Of these dependents, 73 would be children.

The variable of average number of dependents was also examined according to its geographical variation. For the geographic areas previously identified and discussed total average dependents ranged between 1.98 and 2.18 dependents per each accompanied non-local worker. Total average children ranged between 1.05 and 1.28 dependents per each accompanied non-local worker. In both cases, analysis of variance tests produced F values which failed to reject the null hypothesis that there was no difference among the geographic areas with respect to these variables.

4.4 Comparisons with Other Studies

Table 4.4 compares findings on accompaniment of dependents from the IWR construction worker survey with those of other surveys. As can be seen the studies show a great deal of similarity in the proportions and ratios displayed. This similarity enhances the confidence that can be placed in estimates about influx of dependents.

4.5 Type of Housing for Non-Local Workers

It should come as no great surprise that non-local workers typically occupy housing that is different from the local workforce. Table 4.5a presents frequency distributions of the type of housing occupied by the local and non-local workforces. Non-local workers are more likely to occupy "temporary" accommodations such as apartments, mobile homes, motels, travel trailers, etc., while single family homes predominate for local workers. As Table 4.5b shows, however, there are clear differences between accompanied and unaccompanied workers with respect to type of housing occupied. Those workers with dependents present are more likely to favor single family and mobile homes while those workers who may be "geographical bachelors" or single favor motels, boarding rooms, travel trailers, as well as mobile homes.

4.6 Comparisons with Other Studies

Table 4.6 shows striking similarity among the construction worker studies for general frequency distributions of type of housing occupied by non-local workers.

Table 4.4. Comparison with Other Construction Workers Surveys: Accompaniment and Number of Dependents

	Study				
Variable	IWR Construction Worker Survey	WPRS	Battelle	TVA	North Dakota
Percent of non-local workers accompanied	58.9	64.9	51-72[a]	63.4	58.7
Ratio of total dependents to total non-local workers	1.24	1.14	---	---	---
Ratio of school age children (5-18) to total non-local workers	.50	---	---	.56	---
Ratio of school age children to accompanied non-local workers	.85[b]	---	.7 - .9[b]	.88	---

Notes
a. 75 percentile range for 24 surveys
b. Computed as 421 school age children/493 accompanied non-local workers.

Table 4.5. Type of Housing Occupied - Workforce

a	Local		Non-local		b Non-local Only			
					Accompanied		Unaccompanied	
Housing	N	%	N	%	N	%	N	%
Single family	1900	71.5	325	27.4	214	44.1	33	9.8
Apartment	166	6.2	191	16.2	53	10.9	51	15.2
Mobile home	477	18.0	351	29.6	157	32.4	101	30.1
Motel/boarding room	41	1.6	183	15.5	13	2.7	107	31.9
Other (tent, travel trailer, duplex)	73	2.8	134	11.3	48	9.9	44	13.1
	2657	100.0	1184	100.0	485	100.0	336	100.0

Missing = 248

Missing = 391

Table 4.6. Comparison with Other Construction Worker Surveys: Type of Housing Occupied - Non-Locals

	IWR	WPRS	Battelle[a]	TVA	North Dakota
Non-Locals					
Single family	27.4	30.3	30-45	36.7	22.9
Mobile home	29.6	26.1	20-45	36.9	31.3
Apartment	16.2	20.1	10-20	12.5	21.4
Motel/boarding room	15.5	5.9	<10	13.9	
Other	11.3	17.6	<10	-	24.4
	100.0	100.0	n.a.	100.0	100.0

[a] 75 percentile range

4.7 Housing Preference Factors

Surprisingly little research has focused on identifying the reasons for the housing choices that non-local workers make. Chalmers (1977) has indicated that a simple gravity model explains a high proportion of the variation in workforce settlement patterns. Similarly, experience at the Chief Joseph Project showed that most non-local workers opted to settle in a community with few services close to the project site rather than settle in another community only 4 miles more distant with better community facilities (Harnisch, 1980).

In the IWR survey, workers were asked to indicate from among a list of preference factors the two most important reasons for locating where they did. These preference factors included nearness to project, cost of housing, availability of housing, good schools, friends nearby, shopping, community services, and an "other" category where respondents were invited to enter other important factors. Of the 1,212 non-local workers in the survey, 1,866 usable multiple responses were obtained. These are shown in Table 4.7a. As the studies cited above indicate, nearness to the project site appears to be the single most important criterion in choosing location. Other important factors are the availability of housing, the cost of this housing, and the presence of friends nearby. Shopping, good schools, and other community services appear to be less important to the non-local workforce. The "other" choice category responses revealed several answers which are variations on the preference factors provided, e.g., "other" responses: "good country living", "restaurant (nearby)", "to save fuel", "the only place we could find to rent at the time," "school", "near job." Some other answers revealed locational factors that were not included, e.g., "money and girls", "sex", "wild women."

Table 4.7b disaggregates the non-local workforce into accompanied and unaccompanied groups. Accompanied workers are more likely than unaccompanied workers to make location choices based on housing being available to meet family needs. Similarly accompanied workers appear to place greater importance on the quality of schools as a locational decision criterion than do unaccompanied workers. For both groups, however, distance from project site appears to be of paramount importance.

4.8 Intentions to Remain in Local Area

For community impact assessment work it is likely to be helpful to know what proportion of an in-migrating workforce will be resident only until a civil works project is complete, and what proportion may become permanent residents. Such information is critical to a community which does not wish to overbuild in response to temporary needs, later to be faced with long term obligations and a decline in tax revenues. Intention to remain in the local area was measured in the IWR survey by asking respondents: "Do you plan to remain in this town or the immediate area after

Table 4.7. Location Preference Factors, Non-Local Workforce

a.	Non-local Frequency		b. Accompanied		Unaccompanied	
Factor	N	%	N	%	N	%
Close to project	877	47.0	334	43.3	271	52.2
Cost of housing	332	12.4	75	9.7	68	13.1
Availability of housing	377	20.2	176	22.8	92	17.7
Good schools	72	3.9	58	7.5	8	1.5
Friends nearby	164	8.8	60	7.8	44	8.5
Shopping	54	2.9	30	3.9	11	2.1
Community services	12	.6	3	.4	4	.8
Other	78	4.2	35	4.5	21	4.0
	1866	100.0	771	100.0	519	100.0

completion of this project if acceptable employment is available in the area?" This question leaves open the interpretation of "immediate area" to the respondent, however, the question appears to be capable of differentiating respondent's intentions about changing residence area after completion of the project. Again, from the standpoint of information useful for community service impact assessment at this level of detail is sufficient. This question is also similar in wording to one used in Battelle Studies (cf, Malhotra and Manninen, 1979: 82).

Of the 1,212 non-local workers, 31.7 percent responded that they intended to remain in the immediate area after completion of the project, 61.0 percent did not plan to remain, and 7.3 percent did not respond. Table 4.8 summarizes this information and presents the intention to remain broken down by geographic area, and by occupational group(Table 4.10). As can be seen there is little variation in intention to remain in the area across the geographic areas. Among the occupational groups, white collar workers are somewhat more likely to express an intention to move after completion of the project. As might be expected those workers that are accompanied by dependents are somewhat more likely to express an intention of remaining (Table 4. 9), however, the high proportion of non-response to the accompaniment question reduces confidence in the distributions.

4.9 Comparison with Other Studies

Besides the IWR study, only the Battelle surveys have focused on workers' intentions about remaining in local areas after project completion. Information on this variable was obtained by Battelle in four surveys (Malhotra and Manninen, 1979: 82). The Battelle study reports that non-local proportion expressing an intention to leave the area by the time project construction was complete ranged between 50 and 59 percent for the 4 surveys (ibid, p. 87). This is very similar to, although lower than, the 61.0 percent for the Corps workforce.

The Battelle study also looked at variation in intention to remain in the local area across occupation groupings and according to whether workers were accompanied by dependents. Table 4.11 presents this information and compares it with IWR findings. As the Table notes point out, there are definitional differences in the variables employed; however there is enough overall similarity to provide a basis for comparison. Comparing the two studies it appears that a higher proportion of the workforce in the IWR study expressed an intention to leave the study area than what was expressed in the Battelle studies. Differences for the occupational groups are not large. There appears to be a more substantial difference between the two studies with respect to proportions of the non-local workforce accompanied by dependents who expect to remain. There are a number of plausible reasons for the difference. First, is the problem of a significant non-response to the accompaniment question in the IWR survey which may bias results; second, the Battelle results are based on only four surveys. This

Table 4.8. Intention to Remain in Local Area After Project Completion

Intend to Remain in Immediate Area?	Workforce		SE/S		Geographic Area M-W		SW-GP		W		Occupational Groups Unsk.		Skil.		White Col.	
	N	(%)	N	(%)	N	(%)	N	(%)	N	(%)	N	(%)	N	(%)	N	(%)
Yes	385	(31.7)	133	(33.9)	134	(35.1)	76	(32.2)	42	(36.8)	65	(39.9)	252	(38.4)	68	(23.1)
No	739	(61.0)	259	(66.1)	248	(64.9)	160	(67.8)	72	(63.2)	98	(60.1)	405	(61.6)	227	(76.9)
			392	100.0	382	100.0	236	100.0	114	100.0	163	100.0	657	100.0	295	100.0
No Answer	88	(7.3)			No Answer: 88									No Answer: 97		

Table 4. 9. Accompaniment and Intention to Remain in Local Area After Completion of Project

Intend to Remain in Immediate Area	Accompaniment			
	Accompanied		Unaccompanied	
	N	(%)	N	(%)
Yes	190	(41.9)	77	(24.0)
No	264	(58.1)	244	(76.0)
	454	100.0	321	100.0

Missing = 437

Table 4.10. Comparison with Other Construction Worker Study: Intention to Remain in Local Area After Completion of Project

Occupational Group	1WR %	Battelle[a] %
Intention to Leave Area		
Unskilled	60.1	40-50[b]
Skilled	61.6	
White Collar	76.9	60-75[c]
Accompanied Status	*Intention to Remain In Area*	
Accompanied	41.9	55-78[d]
Unaccompanied	24.0	43.58[c]

Notes

a. Source, Battelle report, p. 129

b. This figure for "construction workers" which includes both unskilled and skilled crafts.

c. Non-construction workers

d. Defined as "permanent movers" (those non-locals with dependents present).

e. Defined as "transient movers" (those non-locals without dependents present).

smaller number of surveys could have produced a distribution that is not reflective of the true population figure.

4.10 Commute Distance

Figure 2 graphically illustrates the difference in settlement patterns between the local and non-local workforce discussed in Section 4.4 of this Chapter. As can be seen non-local workers are clustered near to the project. The non-local workforce decreases dramatically in an almost text book gravity function. For non-local workers the average one-way distance commuted to work was 16.1 miles (standard deviation 17.5); while for local workers the average one-way distance was 28.5 miles (standard deviation 22.8).

4.11 Comparison with Other Studies

The findings above support the methodology employed by Chalmers (1978) wherein a gravity function was used to allocate non-local workers around project sites. The results are also consistent with findings reported by Battelle. This study found that 70 percent of all non-locals lived within 20 miles of the project site (Malhotra and Manninen, 1979: 138). This finding compares with 75.4 percent for workers in the IWR study. The North Dakota study reported that locals on average, lived 33 miles from project sites while non-locals averaged 25 miles (Leholm, et al., 1976: 24). These findings suggest that the other location preference factors discussed in Section 4.7 may only assume importance once a distance acceptability criterion has been met by workers.

4.12 Summary

Analysis of non-local characteristics reveals that for the most part non-local workers only expect to remain at their present location until the project is completed. Most workers bring dependents with them. Non-local workers whether accompanied by dependents or not, try to locate as close as possible to the project site. Workers with dependents are also concerned with obtaining housing adequate for family needs. Housing choices for these workers are more likely to run to single family and mobile homes than workers with no dependents present.

In particular the analyses suggests the following:

(1) Approximately 60 percent of the Corps non-local workforce is accompanied by dependents.

(2) A ratio of 1.24 dependents to each non-local worker was computed. This ratio is independent of geographical area of the country where projects are located.

(3) A greater proportion of non-local workers occupy more "temporary" types of housing than local workers (apartments, motels, boarding rooms, travel trailers). More

INSERT TRAVEL DISTANCE TO WORK - LOCAL WORKERS

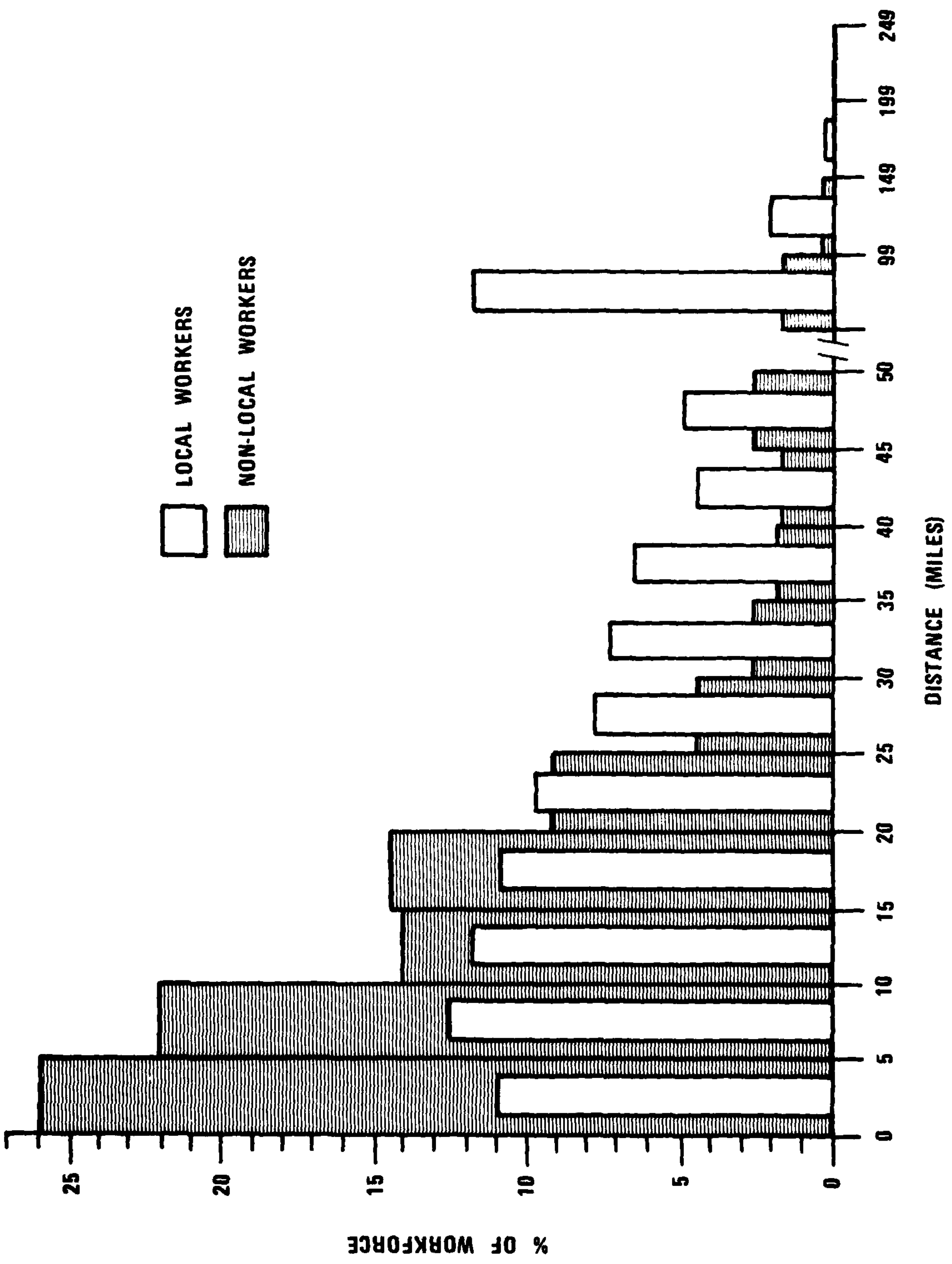

FIGURE 2: TRAVEL DISTANCE TO WORK - LOCAL & NON-LOCAL WORKERS

than 6 times as many accompanied workers, however, choose single family housing than do unaccompanied workers.

(4) For non-local workers nearness to project site seems to be the most important housing choice locations criterion

(5) Less than 1 in 3 non-local workers intend to remain in the immediate vicinity of the project area after completion of the project.

CHAPTER 5

CONCLUSIONS: USING SURVEY DATA

5.1 Employment Benefits

The IWR Study has empirically documented the previous unemployment of the Corps construction workforce. The Table developed offers a means for estimating the employment benefits produced by a Corps civil works construction project. Inputs needed to develop such estimates are as follows:

- Number of workers by skill designation
- Locality of workforce by skill
- Location of project in terms of:

  County EDA status

  Regional unemployment rate

Each of these information inputs is discussed in greater detail below.

Number of Workers

An estimate of the number of workers to be employed on the construction project forms the base for calculating employment benefits. The methodology for deriving estimates of labor requirements for projects is beyond the scope of the present study; however, a number of sources for developing these estimates are available. Among them are statistics maintained by the Bureau of Labor Statistics and WPRS on total dollar amounts of construction for various types of heavy construction activities and man-years of labor (Bingham, 1978; WPRS, 1980); and detailed statistics on construction project labor requirements compiled by F.W. Dodge Co. and made available in labor estimates produced by the Department of Labor's construction Labor Demand System (Department of Labor, 1977).

Locality of Workforce

It has been shown that the previous unemployment of the workforce varies according to the variable of locality. Accordingly, the proportion of the workforce which is local and that which is likely to be non-local should be estimated. The regression equation in Table 3.12 of the survey report provides such an estimation of total numbers of non-local workers. Using Table 3.2, estimates of the occupational skill category of this workforce can be obtained. This Table indicates that for the national survey the non-local workforce was composed of 15.1 percent unskilled

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workers; 59.2 percent skilled and 25.7 percent white collar workers.

Location of Project

Two inputs are required. First, the EDA status of the county in which the project is to be constructed should be determined. Second, a regional laborshed for the project should be constructed using the procedure described in Section 1.3.1 of the report. The unemployment rate for this region can then be obtained from state employment or labor statistics departments.

The information and estimate developed above can then be used in conjunction with the appropriate tables shown in Table 2.17 of this report to develop estimates of previously unemployed workers. Appropriate wage rates can be multiplied by these workers to yield estimates of employment benefits.

For example, assume a reservoir is to be constructed; assume a three-year construction schedule. Labor requirements of construction are: year 1 = 250; year 2 = 700; year 3 = 300 workers.

The estimated occupational distribution of workers is as follows:

	Construction Year		
	1	2	3
Unskilled	55	154	66
Skilled	160	448	192
White Collar	35	98	42
	250	700	300

To compute employment benefits, perform the following steps:

a. Locality of Workforce

(1) Estimate total non-local workers using regression equation:

Number year 1 = .213 (PEAK*) -8.9 = 44

year 2 = = 140

year 3 = = 64

(2) Estimate occupational breakdown of non-local workers.

------

*where PEAK = number of workers required for construction year.

	Construction Year		
	1	2	3
Total Non-local workers by occupational category	44	140	64
Number unskilled = 15.1% X total	7	21	10
Number skilled = 59.2% X total	26	83	38
Number white collar = 25.7% X total	11	36	16
Total	44	140	64

Non-local workers

(3) Estimate occupational breakdown of local workers. Subtract non-local to obtain.

	Construction Year		
	1	2	3
Unskilled	48	133	56
Skilled	134	365	154
White collar	24	62	26
Total	206	560	236

Local Workers

b. Location of Project

(1) EDA status: Assume county is located in EDA-designated area.

(2) Regional unemployment rate: 6.9%.

c. Compute previous unemployment

(1) Estimate previously unemployed local workers.

Year 1	Total local workers		Values from Table 2.17		Number Previously Unemployed
Unskilled	48	*	.427	=	21
Skilled	134	*	.328	=	44
White Collar	24	*	.221	=	5

(2) Estimate previously unemployed non-local workers

Year 1	Total local workers		Values from Table 2.17	Number Previously Unemployed
Unskilled	7	*	.320	2
Skilled	26	*	.213	6
White Collar	11	*	.221	2

(3) Repeat (1) and (2) above for construction years 2 and 3.

d. Compute a wage bill for previously unemployed workers. Assume an "average wage" for occupational skill levels of $8.00/hr, unskilled; $13.00/hr. skilled; $12.00/hr. white collar.

(1) Wage bill, year 1 = x+y+z where
x = total number of unskilled workers previously unemployed * year 1 annual wage unskilled
= 23 * $16,640 = $382,720
y = Total number of skilled workers previously unemployed * year 1 annual wage skilled
= 50 * $27,040 = $1,352,000
z = Total number of white collar workers previously unemployed * year 1 annual wage white collar
= 7 * $24,960 = $174,720
x+y+z = $1,909,440

(2) Compute wage bill for years 2 and 3 in same manner

(3) Compute total wage bill for previously unemployed workers by summing wage bills for years 1 through 3

(4) Compute interest on wages paid to previously unemployed workers. (Compute as described in EM 1160-2-101).

e. Compute Average Annual Employment Benefits

(1) Total employment benefits = total wage bill + total interest on wages

(2) Average annual benefits = total employment benefits * amortization factor. For example, total wage bill in this example = $9,549,280, total interest on wages = $887,190
amortization factor is .075914 assuming a 50 year project life at 7 5/8 % discount rate
average annual employment benefits = $792,274.

5.2 Community Service Impact Assessment

The survey data analyses coupled with the comparative data assembled from other construction worker studies provide a solid empirical base to assess the demand on community services that a Corps project is likely to produce. The procedure for performing such an impact assessment using the survey data is shown in the example below.

As a planner for a Corps of Engineers reservoir project in final design stages, you have been asked by local governments in the reservoir project area to provide an assessment of the impact of the construction project on the community services in the project area. There are several small towns in the vicinity of the construction site and local governments are interested in identifying the range of likely benefits and costs the construction project will produce. What can you tell them?

Information provided by the survey can be used to perform a community impact assessment. The first step in such an assessment would be to calculate the number of non-local workers likely to be employed on the project. Using the regression equation in Table 3.12, an estimate can be produced. Assume that the relevant data for this equation were:

- Peak anticipated construction: 700
- Constant: 8.9
- Peak number of non-local workers: 140

Next, using the ratio of 1.24 dependents per non-local worker obtained in Chapter 4, an estimate of 174 dependents is derived. Total population influx directly associated with the construction project is thus estimated to be 314. Of the dependents, approximately 102 will be children and, of these 102 children, 79 will be school-age.

Housing needs of the incoming workforce can be projected using Tables 4.1 and 4.6. Here, the expected non-local worker population could be broken into 83 accompanied workers and 57

unaccompanied workers. Housing needs of these groups as expressed in Table 4.6 could be derived and matched with available supplies in surrounding communities.

Data strongly suggest that the communities located nearest to the project construction site will receive most of the total population influx of 314. Statements on the actual distribution of this population among nearby communities would have to be conditioned on separate assessments of supply of housing as well as on local government policies to attract or discourage incoming workers. Harnisch (1980), for example, found that one community adopted an aggressive policy to attract as many incoming workers as possible. In this community, zoning restrictions were relaxed and workers were exempted from paying local property taxes. Such policies should be factored into any assessment.

Having identified total worker-dependent influx and having made some judgment of settlement patterns informed by the survey data, as well as local conditions, an assessment of the impact of this influx on existing community services - schools, sewage systems, roads, etc. - can be made.

A method for performing this assessment developed by the Seattle District involves the following steps:

(1) Make "without project" population forecasts for local communities which are likely to be affected by construction-induced population increases.

(2) Inventory the "people capacity" of community services of these communities in relation to "without project" population forecasts.

(3) Allocate incoming populations to local communities on the basis of the survey data presented in this report, as well as on personal knowledge of the local area.

(4) Identify any shortages in community service capacities produced by, or worsened by, the influx of construction workers and dependents. Figure 3, showing how this information can be graphically displayed, is modeled off of a community impact study prepared by Seattle District (Harnisch, 1980). A forthcoming IWR report (Chalmers) provides detailed procedures for identifying, quantifying, and displaying community service impacts.

Data from the survey suggest that of the 140 non-local workers, 44 would remain in the local area after the project is completed (Table 4.9.). Of these 44 workers, 26 accompanied workers are included representing about 81 persons, making a total number of individuals who are likely to remain in the local after completion of the project 99. This information can help local governments plan on the character of capital expense outlays for providing services to incoming workers.

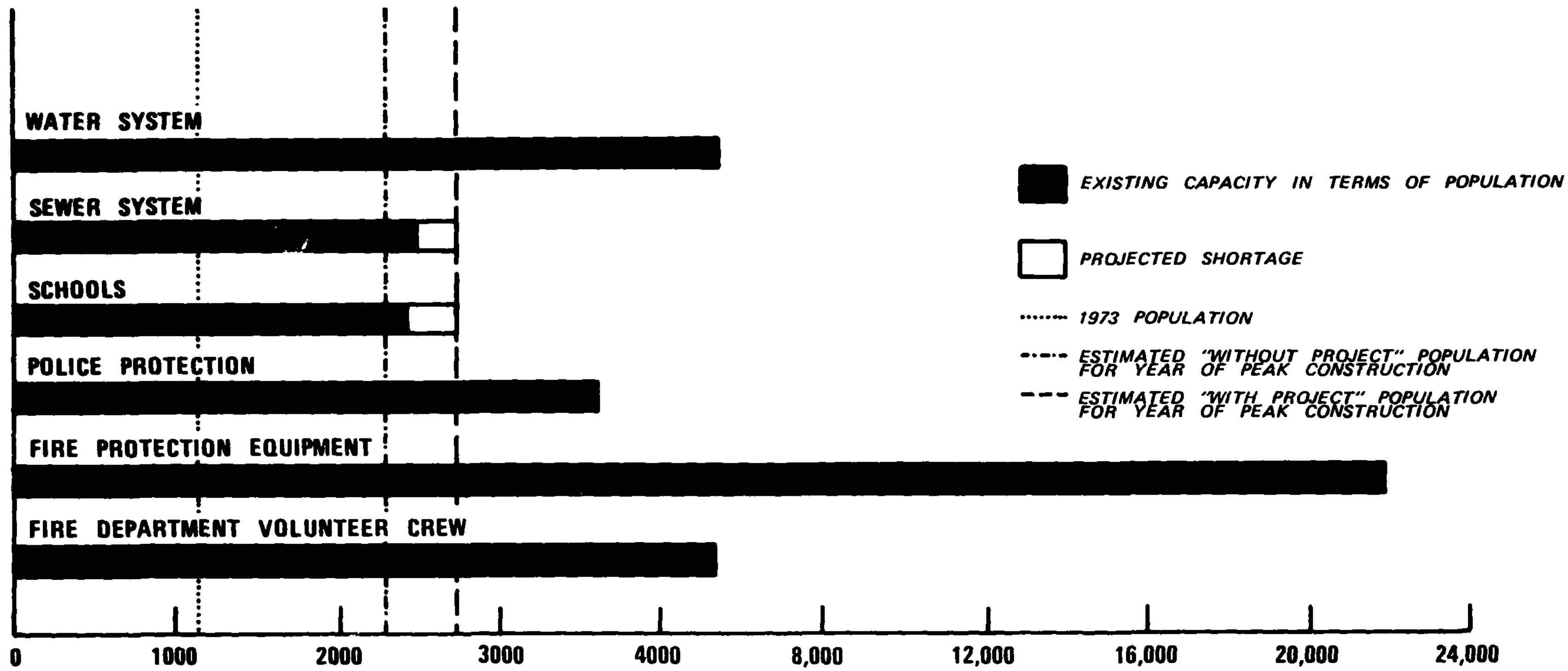

FIGURE 3: SAMPLE DISPLAY OF COMMUNITY SERVICE IMPACTS OF CONSTRUCTION GENERATED POPULATION INFLUX

Such information can provide Corps planners with the means to assist local governments in planning for and managing impacts associated with a Corps construction project.

It should be noted that the uncertainty concerning such community impacts is likely to be worse than the actual impacts themselves. For example, the "average" project in the current survey had 124 workers employed at the time of the survey. Of these workers, it is estimated that 40 were non-local. Assuming the ratio of 1.24 dependents per non-local worker, the average construction project brings only about 90 persons into the local area. In most local project areas, a population influx of this size would not produce appreciable community service impacts.

APPENDICES

Appendix A

The information on this form is needed:

- to help measure the social and economic effects of projects on local communities,
- to provide information that can be used by local communities in dealing with these social and economic effects.

The U.S. Army Corps of Engineers is handing these questionnaires out at its projects all over the country. By filling out this short questionnaire you will be providing information that will be very useful to communities near Corps of Engineers projects. No names or other identification are asked; your answers cannot be traced to you. THANK YOU FOR YOUR HELP.

1. What is your occupation (job title)?______________________________

2. Where is your local place of residence now?______________________________
(Town or City) (State) (Zip Code)

NOTE: Your local place of residence is the place from which you commute daily to your job. It may not be your permanent address or the address at which your family is located.

3. a. Is this where you lived before you started working on this project? (Circle one) YES NO

b. If NO, where did you live before ______________________________
(Town or City) (State) (Zip Code)

c. If NO, check the 2 most important reasons why you chose the community or locale in which you settled while working at the project.

____close to project worksite ____good school system ____community services (police, fire)
____cost of housing ____friends or relatives nearby ____other (write in below)
____availability of housing ____shopping facilities ______________________________

4. What is your current local place of residence? (Check one)

____single family house ____mobile home ____duplex, condominium
____apartment ____motel ____tent
____travel trailer, camper van ____boarding, sleeping room ____other

Please complete questions on reverse side of form

OVER

5. How far do you travel (one-way) to get to work? ________miles

6. When did you first start working on this project? ______________________________
(Month) (Year)

7. a. Were you unemployed at any time during the six weeks before you started to work on this project? (Circle one) YES NO

b. If YES, for about how many work days were you unemployed during the six weeks period? ______________days

8. Do you plan to remain in this town or the immediate area after completion of this project if acceptable employment is available in the area? (Circle one) YES NO

9. a. What is your age? _______years b. What is your sex? M_______ F_______

10. Last grade you finished in school? ______Grade (If you have college, first year college = 13, 2 years of college = 14, etc.)

11. Are you now married? (Circle one) YES NO

ANSWER THE FOLLOWING QUESTIONS ONLY IF YOU HAVE A WIFE (HUSBAND) OR CHILDREN:

12. How many children do you have in the following age groups?

a. Check here if you do not have any children ______ c. 5-12 years (Grades K-6)_______ e. Over 18 years of age ________
b. 0-4 years (Preschool)______ d. 13-18 years (Grades 7-12)_______

13. a. Do your spouse and/or children live with you at the local place of residence from which you commute to work daily? (Circle one) YES NO

b. If NO, where do your spouse and/or children live?______________________________
(Town or City) (State)

U. S. ARMY CORPS OF ENGINEERS

Appendix B

Appendix B - Selected Survey Data from North Atlantic and New England Division Projects

Projects Surveyed:	Yonkers, NY
	Potomac Estuary, MD and VA
	Bloomington Lake, W. VA.
	Blue Marsh Lake, PA
	Cawanesque Lake, PA
	Tioga-Hammond Lakes, NY
	New London, CN
	Park River, CN

Date Surveyed: October, 1978

Questionnaires Distributed: 1457

Number completed: 677

Response Rate: 46.5%

Table B-1. Employment Status; by Occupation

			Unskilled		Skilled		White Collar	
	N	%	N	%	N	%	N	%
Previously unemployed	319	47.1	84	54.5	212	49.1	19	30.2
Employed	342	50.5	70	45.5	220	50.9	44	69.8
No Answer	16	2.3						
Total	677	100.0						
Average Duration of Unemployment (Days)	28.8		28.5		28.9		28.1	

Table B-2. Locality of the Workforce; by Occupation

			Unskilled		Skilled		White Collar	
	N	%	N	%	N	%	N	%
Local	473	69.9	128	83.1	303	69.7	38	59.4
Non-local	191	28.2	26	16.9	132	30.3	26	40.6
No Answer	13	1.9						
TOTAL	677	100.0						

Table B-3. Type of Housing - Non-locals

	N	%
Single Family	39	20.7
Apartment	26	13.8
Mobile Home	46	24.5
Motel/Boarding Room	47	25.0
Other	30	16.0
TOTAL	188	100.0

Appendix C

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Appendix C: Population - Sample Comparisons

Table C-1. Project Population and Project Sample Distribution

Project Type	Population	Sampling Fraction	Sample
FC	57	.6	34
R	29		17
P	13		8
CH	13		8
LD	12		7
BE	3		
R-LD	3		6
R-CH	3		
R-FC	2		
R-P	1		
TOTAL	136		8

Table C-2. Comparison of Population and Sample Characteristics: Distribution of Projects by Type and Division

POPULATION

Project Type a.	Division b.								
	SAD	ORD	LMV	NCD	MRD	SWD	SPD	NPD	TOTAL N/%
FC	3	4	15	11	6	10	7	1	57 41.9
R	2	9		1	2	12	2	1	29 21.3
P		1	2		1			9	13 9.6
CH	4		6	2	1		1		14 10.3
LD	2	4	4			1			11 8.1
OTHER	3	1		6		2			12 8.8
TOTAL	14	19	27	20	10	25	10	11	136
N/%	10.3	14.0	19.9	14.7	7.4	18.4	7.4	9.1	100.0

Table C-2, Cont'd.

Sample

	SAD	ORD	LMV	NCD	MRD	SWD	SPD	NPD	TOTAL
FC	2	2	7	6	4	6	4	1	32 40.0
R		7			1	7	1	1	17 21.3
P		1	2		1			5	9 11.3
CH	3		4	1					8 10.0
LD	1	2	3			1			7 8.7
OTHER	2	1		3		1			7 8.7
TOTAL	8	13	16	10	6	15	5	7	80
	10.0	16.3	20.0	12.5	7.5	18.8	6.3	8.7	100

Table C-3. Comparison of Population and Sample Characteristics: Distribution of Projects by Type and Division

REVISED POPULATION

Project Type a. Division b.

	SAD	ORD	LMV	NCD	MRD	SWD	SPD	NPD	TOTAL N/%
FC	3	4	11	9	4	8	5	0	44 41.1
R	2	9		1	1	10	2	1	26 24.3
P		1	2		1			4	8 7.5
CH	4		3	2	1		1		9 10.3
LD	2	4	3			0			9 8.4
OTHER	2	1		4		2			9 8.4
TOTAL	13	19	19	16	7	20	8	5	107
N%	12.1	17.8	17.8	15.0	6.5	18.7	7.5	4.7	100.0

Table C-3 (Continued)

Revised Sample

	SAD	ORD	LMV	NCD	MRD	SWD	SPD	NPD	TOTAL
FC	2	2	3	4	2	4	2	0	19 37.3
R		7			0	5	1	1	14 27.5
P		1	2		1			0	4 7.8
CH	3		1	1					5 9.8
LD	1	2	2			0			5 9.8
OTHER	1	1		1		1			4 7.8
TOTAL	7	13	8	6	3	10	3	1	51
	13.7	25.5	15.9	11.8	5.9	19.6	5.9	2.0	100

Table C-4 Average Number of Construction Workers Employed by Project Type. Comparison of Revised Population and Sample.

Project Type	Revised Population [a]	Revised Sample [a]
FC	71.5	77.7
R	121.3	103.7
P	278.3	267.3
CH	30.0	19.0
LD	251.8	411.8
Other	70.1	112.0
TOTAL	105.1	128.6
TOTAL:[a]	10,823	6,559
Number of Projects	103	51

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[a] Estimated workers employed on projects; obtained in September 1978.

[b] Excludes new starts which had no employees in September 1978.

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